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PAGE 86-87

XUM

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An Airy Chat With the Editor

SO MANY things have happened this month, aeronautically speaking, that it is difficult to recount all of them at one sitting. In spite of present conditions, many new planes have been developed, there are at least five new engines that have made their bow to the public and there are other developments of a like nature that promise great things for the future.

And this is not only the case in this country, for in France and Germany we find much experimenting, designing and general aviation development going on. True, there are no great immediate returns from all this work, but we are building up a firm foundation for future years.

* * *

IF YOU page back through this issue, you will find a new department. While this is intended fundamentally for the benefit of homebuilders, amateur aviators and others of the lightplane and glider fraternity, yet we believe that the laymen will also be interested. This new department is called, "Howl Department for Amateurs," and the title tells just what it is.

It is in this column, with the assistance of our readers, that we hope to work out some solution for the vexations, annoyances and restrictive measures that are almost daily being levied upon the amateur. Remember, you fellows, that this is your department and is wide open to you, just so long as your letters are constructive and pertinent to the subject. Come in, the water's fine!

* * *

AS THE months roll on, the writer is becoming more and more impressed with the fact that our subscription list is just one big family—all for one and one for all. You just have to suggest once that you are running short of something and there will be a bunch of letters—pronto—to help you out. This is sure a degree of cooperation that I have never before witnessed, and I have been monkeying around with magazines for a good many years.

* * *

OUR readers have built planes powered with the venerable Model T" Ford engine. They are also using the Model "A" Ford engine with even better results. Therefore, we wonder just how long it will be before a lightplane will appear with the new eight-cylinder Ford engine under its hood? From the performance that the eight lunger gives the new Ford car, I rather expect that the eight will revolutionize amateur aviation. It certainly is a peppy little machine, and practically free from the vibration experienced with the old four cylinder engines, both the "A" and the "T".

* * *

AND there is one thing that I would like to call your attention to. POPULAR AVIATION has always tried to be unbiased and open-minded upon any matter that concerns aviation. You will no doubt remember that whenever a controversy arises, or a difference of opinion exists, that we print articles written by both parties to the question—usually on facing pages. We did this in the case of the Liggett articles, in the case of the Cord Wage Controversy, and even when the writer, J. B. R., broke loose with more or less radical statements. We always endeavor to show both sides of the banner equally and without fear or favor.

Now comes a reader who waxes exceeding wroth on the subject of Cap Purcell's last articles in which 'Ole Cap lambasts the conditions that surround the transport pilot. We could, of course, reply to this letter in this issue, but we rather preferred to have Cap Purcell defend himself, which he is amply capable of doing. And so, because of the delay in sending this letter to Purcell, you will see a red hot letter from Purcell standing his ground against the plaintiff in our next issue.

* * *

WE LIKE debates and we love controversies, just so long as they lead to some useful and illuminative conclusions. About the only time that a man will unbutton his soul and yell his stuff right out in meeting, is to get him mixed up in some sort of an argument on a subject that is dear to him.

* * *

WE HAVE had a very nice letter from Senator Bingham, who, as you remember, put the free civilian training bill before the United States Senate. As we have explained before, the Senator is an aviation fan of the most enthusiastic type, and his object has always been to favor aviation wherever it is possible. His bill, the Bingham Bill 4142, is just one more of his notable contributions to the science of flying. His letter reads as follows:

Dear Editor:

Many thanks for the excellent article contained in the July issue of POPULAR AVIATION *on my Bill to provide a five-year training program for the training of pilots for an unorganized reserve for the Army Air Corps.*

Let me assure you that I deeply appreciate your gracious cooperation in giving so much space in your magazine to this subject. I should be interested in learning what reactions you get from the replies.

Your helpful interest and offer of service are deeply appreciated. I shall be pleased to let you know later about the disposition of the 7000 names of your readers who have signed the petition to which you refer.

Sincerely yours,
(Signed) Hiram Bingham.

* * *

IF SENATOR BINGHAM had the pleasure of opening and reading the thousands of enthusiastic letters that we have opened, we are sure that his mind would be at rest in respect to the reactions of our readers and their friends. They are for it, and we have had only a very few letters—five to be exact—which questioned the wisdom of adopting such training.

* * *

IN THE hope that that one of our readers may be assisted in realizing his ambitions, we are presenting the letter of Arthur Sullivan, 1932 E. 97th St., Cleveland, O., who wishes to break Bert White's parachute record. And here it is:

I have just about completed final arrangements for an attempt to break Bert White's record for parachute leaps at the National air races this fall.

I have the backing of one of the largest corporations in Ohio and am planning to use both a Switlik and Irwin 'chute. As yet there is no arrangement with either manufacturer although I believe such an arrangement will not require too much effort.

I am not a professional jumper. Have been flying over three years and at present am employed as pilot with a local motion picture organization.

I have been studying conditions in the upper atmosphere and consulting

(*Continued on page* 122)

POPULAR AVIATION

Combined with Practical Mechanics, Including Aeronautics and Aviation Stories and Mechanics

A Magazine for the Promotion of Amateur Aviation and Private Flying

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D'ja Ever Fly a

by LIEUT.
FRED VICTOR GRIFFIN
Illustrated by Herman R. Bollin

I WENT to the picture show a few nights ago, a very interesting one too—the picture was all about flying, and oh, boy! the ending was just great. The heroine greeted her aviator lover with open arms and gallons of glycerine tears of joy. I was positively thrilled until I was rudely awakened by my thoughts automatically reverting to the past.

Something seemed to remind me, I guess it was just the difference, how I used to get a reception too when I landed. It was usually from the commander after about a thirty-hour patrol and consisted of a hearty "who the hell ordered you to land?"

* * *

It took me back to those years, long past when, with a gas bag above, I did another kind of flying in search of German submarines along the English coast.

As observer on a "flying-pig," as the old coastal type of blimp or dirigible was known, I had seen many strange and stirring sights that are almost past the telling. And coming back to the subject—my receptions were not always so satisfactory as the reception portrayed upon the screen.

* * *

A YOUNG officer stepped up to us quietly—he knew how and gave his orders.

"Come on you chaps—eight ships been torpedoed and we're ordered out—hurry up now."

These few quiet words roused us to immediate action. We were up and stumbling through the heavy snow in the two o'clock morning blackness in about two seconds. We never undressed—it was too risky to take a chance of losing time.

Still dead tired, for we had landed less than an hour before from a long patrol, we stumbled on into the enormous shed housing the lighter-than-air fleet where the engines were already whirring an irritating "here we are again."

Six hundred men were shovelling as though for their lives, clearing snow from the shed's tremendous sliding doors, for snow had been falling on and off all day. The gas guards were shooting the hydrogen up to pressure, engineers tuning up, observers testing wireless, Lewis guns, bombs and signals and riggers were giving her the final "once over".

The landing party of two hundred men marched in and took their positions. Two orders snapped through the morning atmosphere,—"Quick march" and then "Let go", and we were soon a thousand feet up in the mist. This was way back in 1915, when the "flying pig" was doing her stuff.

WHAT a night, what a night! The old "flying pig" surely wallowed in the dirty yellow mist and snowy drizzle. The raw cold air chilled us through from the start and the two thousand revolutions per minute from our forward propeller seemed to thrust the very Arctic into our souls. We were flying pretty light, for she was fully gassed and rising without the aid of engine power—in fact a very few minutes found us in the complete blackness of the upper atmosphere. There was nothing beneath us excepting the mist and drizzle—no stars above—just a blanket of intermingling fog banks surrounding us. We must have been over the coast, but who can tell on a night like this, so we heaved the elevators down and shot the engines full ahead. We made a dive—then, as she steadied

Pig?

FLYING a light dirigible or "Blimp" along the English sea-coast is here made the basis of an intensely interesting and unusual story. A true story dealing with a side of aerial warfare not often related.

up again the pilot eased up on the engines as he shouted, "Say, Yank, can you make out where we are yet?"

I took a swing with my foot and clinging to the rigging, was on my way along the thin rail on the outside of our open car to consult the pilot. Then I felt a heavy jerk and I automatically looked down in time to see a peculiar pointed shadow pass. I hung on for dear life, the pilot eased the elevators, and the coxs'n took a sharp turn to starb'd.

I noticed the wireless aerial swinging below and part of it was gone. Suddenly I realized our position, "It's all right," I shouted to the pilot, "but we're a little early for morning services. That's Peterhead Cathedral we just passed, and the top of it's dangling on my aerial."

And so our position was more or less settled, for in dirigible patrolling one becomes accustomed to sort of sensing their course through the darkness. I signalled my green and yellow lights on the undercarriage to notify the coast-guards we were outward bound for patrol, but this was just a matter of form, for I doubt whether they could be seen beyond the length of the skids.

The next item on the program was getting signals through to the direction finding station, so the skipper set his course N. E. E. whilst I was monkeying in true monkey fashion on the skids, endeavoring to get a new aerial fixed up. One arm was through the bracing wires, one leg was around the struts. The other leg was trying to complete the balance on the insulator and with the only free hand I twisted the wires into position—a feat quite equal to the stunts of a handcuff king.

It was not very long before I had checked up on our position and was decoding instructions to escort the convoy which had been attacked and to circle for the offending German submarine. Our patrol took over an area running from Aberdeen to Scapa Flow via Moray Firth, over the fishing banks and circling clear out over the North Sea.

Northeast from this section of the Scottish coast we made for Wick on the north side of Moray Firth. A light breeze was no blowing, the fog was clearing and there was the first sign of the heavens above. The haze below was giving place to the solid blackness of the sea—so we lowered our elevators and came down to about three hundred feet to get clearer vision.

Suddenly there was a dull thud. The whole rigging and car shook as though we were in an earthquake. The envelope began to "breathe hard," and for a moment I thought we were "goners". However, we steadied very quietly and a quick observation indicated the cause of the trouble—a small fleet of mine sweepers were looking for enemy mines along the coast, and the leader happened to find one just about the time we had dipped in salute to old King Neptune.

It was all over in a few seconds. The remainder of the sweepers did not swerve from their course, for it was no use looking for their comrades, the ship and crew being blown to absolute dust at the moment of their contact with the mine. We signalled the sweepers and found that they were clearing up the area which had been recently visited by an enemy submarine mine layer.

LIEUT. GRIFFIN, the author of this interesting article, served during the war as an observer on an English blimp or "Pig". Having had several years' experience in flying dirigibles, he is thoroughly familiar with the subjects related here.

Protecting merchantmen and troop convoys against German submarines and German mine-layers was the duty of this branch of the service. As the technique of handling a blimp is entirely different from the operation of an airplane, this true story is instructive as well as interesting.

WE NOW turned a few points to the eastward and were about to ascend again, when a white patch showed itself quite distinctly against the black waters. I flashed my hand signalling light on it and it was a queer, gruesome spectacle indeed. A pilot house had just blown and was ripped clean out of the ship that had been torpedoed. Just a few hours before, she had been a peaceful merchant ship on the last lap of her homeward journey with a cargo of necessities for her war ridden country.

A big boom was prodding the pilot house and completing its demolition with the wash of the waves, other smaller pieces of wreckage were strewn about and there was a long trail of the dastardly work of the undersea wreckers extending for miles.

And, as we were pretty close to our scene of activity, we changed our course slightly and were soon over the remainder of the convoy, plodding hopefully along. We gave a short signal and proceeded to circle, keeping a sharp lookout for enemy undersea craft. A small object now appeared below and we descended another hundred feet. It appeared like a small fishing schooner, but there were no lights. We thought, maybe it was a trawler with her fore'sl out, so I fired the Very's light signal pistol.

There was no response and the white patch seemed to suddenly disappear—perhaps it was merely fancy. I set my bomb sight, but hesitated, for we could not afford to waste these precious "eggs". There were so many peculiar craft at sea in wartime that navigating methods were completely changed, and our own mystery ships pulled strange antics—so I wirelessed the base ashore figuring they would direct the destroyer patrol to this area.

With this off our minds, we shot ahead of the convoy to continue our lookout. Everything seemed to be going quite smoothly, but we found ourselves gradually losing lifting power practically during the whole time that we had the elevators up and engines full ahead to keep us on an even keel. After a while longer, the controls began to get difficult to handle, the envelope was sagging slightly, and the pilot eased up on the engines, letting go some water ballast.

"Yank, give her the once over—hustle, there's something radically wrong—she's losing lift fast." I did not hesitate a moment at the pilot's words, I knew too well what they meant, the same thing had happened on the C71 when she lost her lift. Everything was thrown overboard, even to the auxiliary engine, but it was no use. They finally had to jump for it and some came back with the destroyer patrol, whilst the other boys lost their gamble with life.

I GRABBED the leak detector, made a jump for the gun tube ladder and swung wide of the car, bouncing like a monkey on a Christmas tree as I climbed the rungs and struggled up through the gun tube which runs through the gas bag to the top where

a Lewis gun is mounted. I crawled along the top of the gas bag, making my tour of inspection, and swung around the nose with my feet hooked in the king posts. I looked every conceivable place for a leak after an hour of acrobatics.

I gave up the ghost and descended through the gun tube, climbed along the lower rigging from which the car was slung where I met with better luck. Here I discovered a bad hydrogen leak right by one of the main suspensions. Apparently the jar from the mine explosion, when the sweeper had gone up in smoke earlier in the patrol, had had its effect.

This finished, I jumped to the auxiliary engine, hooked up the wind chute, and pumped air into the ballonets, to get up gas normal pressure and to get the controls straightened out again. Everything seemed to be O. K. again and we started off full speed ahead to rejoin the convoy, but had scarcely got under way, when a red and a green rocket flared on the horizon.

I jumped to the wireless, gave a signal and immediately received instructions to proceed to the fishing banks and stand by. The destroyer patrol had been ordered out to cover the area reported by us when the mysterious apparition of a fishing schooner had disappeared before our eyes and had apparently seen some signs of an enemy submarine.

We had hovered over the banks, it was quite daylight by this time, when there appeared to be a peculiar disturbance some distance under the surface. I sensed a dull shadow way down under, but it was quite still. I paused a moment, for there were many peculiar views of sunken vessels to be seen under the sea along the coast and around the banks.

I got the pilot to swing and circle back again, got my bomb sights ready and with a little pull of the toggle, the forward starb'd bomb fell into space. In a few seconds, there was a tremendous upheaval of the sea and a dirty black patch showed up. I fired my Very lights and the destroyers closed in quickly. They darted in circles like a bunch of flying fish, dropping depth charges as they went. In a few more minutes, Heinie had met the fate he had meted out to the merchant ships on the night before.

BY this time, the convoy, which we had been endeavoring to accompany, had passed into another area and one of the air patrols further south had taken over the scouting job, so that we were free to return to base. We re-set our course for home, sleep and food, heaved a sigh of relief all round and set back with visions of a well earned day off.

We were nearing the high cliffs north of Aberdeen and I was just about to reel in my aerial, giving the usual signal before doing so, when to my utter disgust, instructions buzzed through from the base to "remain on patrol and to keep a close lookout for further orders". We eased up on the engines, just kept them ticking over, whilst we free-ballooned out to sea again, giving everyone a chance to recover from the shock of our disappointment.

By this time, everyone was ravenously hungry, and we began rummaging around the corners of the car to see if the rats had left anything. I happened to be the only lucky one, for as I wiggled around in my small space in the gun mounting, I kicked the Lewis gun ammunition rack and out fell a pan. Lo and behold, a glorious chunk of navy rock was hiding beneath it. Did you ever try this naval combination of beverage convenience? It's the world's eighth wonder, a combination of cocoa-in-the-rough, sugar a la glass, milk nuggets plus nine-tenths of one hundred per cent cement. Nevertheless, in our terrible state of famine, it was welcome as the flowers in May.

"Wonder what the hell Trunky (the

(*Continued on page* 124)

From the blimp and other non-rigid dirigibles came the rigid dirigible of which the "Akron" is one of the finest examples. Here we see the "Akron" with an old four-masted schooner in the background.

Optical Communication for the Plane

This is the optical signaling device now being used in Germany.

IN THE passenger transport planes, communication among occupants sitting one behind the other, is subject to many difficulties. These are very disturbing, especially with instruction and military airplanes.

Acoustical remedies are not an ideal solution of the problem, for the occupants are severely hampered by the necessary ear-phones, as well as by the dangling cable. Besides this, the noise from the motor often prevents a satisfactory understanding.

The optical communication apparatus described here has been recently developed in Germany and removes this defect. It consists of a three lamp apparatus, one lamp red, one green and the third white, together with a three-pressbutton device. The normal airplane voltage is used for the operation of the apparatus.

The communication is made according to a previously accepted system, by the transmission of a definite number of flashes in special combination and special colors, each one of which has a special significance.

As the communications are by signal only, and are not telephonic, it is evident that they are best adapted for emergency signals.

Movable Engines for Seaplanes

BY THE use of "movable" engines, the speed of racing seaplanes may soon, it is claimed, be increased to 500 miles an hour. This new type of engine-mounting for aircraft is patterned after the design and construction of the British Schneider Trophy racers, which last autumn established a world's record speed.

The inventors have mounted the engine on a pivot which permits the engine and propeller to be tilted upward to any desired angle within a range of nearly forty-five degrees. The upward tilt not only lifts the propeller clear of the water but has enabled the designer to shorten the under carriage. With the wing of the plane resting almost on the water, the air resistance and weight of the under carriage have been greatly reduced.

While this idea is not strictly new yet it is entirely feasible, and a somewhat similar arrangement was briefly described in the December issue.

When Ace Meets Ace

THE undisputed aces on the western front during 1915-16 were Rhys-David, Britisher, and Capt. Oswald Boelke, German. Both headed a squadron of picked aerial duelists and had sent their share of enemy planes to earth in single combats. A transfer brought Boelke to Rhys-David's sector.

One day Capt. Rhys-David had just landed after a terrific formation fight in the clouds, in which he had despatched two German machines single-handed, when a lone German plane was observed approaching at a great speed but flying barely a hundred feet above the ground. When directly over the British airdrome, the German dropped a bit of paper. It was a note reading: "Will Capt. Rhys-David give Capt. Boelke the pleasure of his company in single combat tomorrow 8 a. m., 8,000 metres above Cambrai field?"

Cambrai was Boelke's home field. Promptly at 8 next morning Rhys-David was over the German field at the height named. Boelke's red-nosed, iron-crossed Fokker roared up to him. For an hour the two enemy aces sparred in battle. Both being polished flyers and experienced fighters, their duel was an endless series of diving, zooming and circling, each striving to get the advantage for a fatal shot, which the other was skillful enough to anticipate and out-maneuver. At last, tiring of it, Rhys-David waved his foe a farewell, which Boelke politely returned, and both returned to their airdromes.

Several times Boelke then appeared over the British field, challenging Rhys-David to battle, which the Britisher accepted. But both being equally competent they sparred until tired of it or Boelke was compelled to return home because his fuel was running low. A dozen times, when the two aces led their picked squadrons to combat, they left their formations to their fate to have it out between themselves. Below all trench activities were halted as all eyes turned upward to watch the two aces duel, but always these singles ended in a tie.

At last, in October, 1916, Boelke surprised his arch adversary and sent him spiralling to his death in flames. A few weeks later a member of Rhys-David's unit sent Boelke hurtling earthward, a machine gun bullet through his head.

Invents a New Chute

NEW features are involved in a specially constructed parachute for dropping mail bags from planes in flight invented by Charles M. Graeg. The new features include an illuminating lamp and a hook for attaching the mail bag. The design eliminates all danger of the parachute becoming entangled in the tail of the plane.

Latest Army Pursuit Plane is Speedy

Three-quarters view of the new Army speed marvel (XP-936).

THE latest Army Pursuit airplane, a Boeing, known as the XP-936, has arrived at the Materiel Division for inspection and performance testing. It is rated among the fastest pursuit airplanes in the world. This small single-seater all-metal monoplane incorporates the most modern features of design known to aviation.

It is a radical departure from the existing airplane used for combat purposes. The fuselage is a clean highly streamlined monocoque structure, the semi-low wing having a smooth metal skin covering. This wing consists really of two parts, a stub which is integral with the fuselage and the wing proper.

The landing gear is a single-strut, vertical, wire-braced type with the shock-absorbing element carried through the wing stub to the fuselage. Landing gear struts and wheels are provided with streamline fairings. The wheels are interesting, being the first of a new streamlined type.

The ailerons and rudder are unbalanced, whereas the elevator is of the "overhung" type of balance. The stabilizer is fixed, the longitudinal balance being obtained by means of trailing edge stabilizing flaps.

The power-plant is a new supercharged Pratt & Whitney Wasp engine. The supercharger forms an integral part of the power-plant proper, similar to the blower on the commercial types of this engine, which should make possible speeds greater than heretofore attained at high altitudes by air-cooled installations.

This airplane represents a record in the production of an experimental model, less than six months having transpired since the design was conceived and the first drawings made.

Layout of the Sunnyvale Dirigible Base

Artist's schematic layout of the new dirigible base at Sunnyvale, Cal., showing grounds and shed. This is a stupendous undertaking.

THE proposed air station for Sunnyvale, Calif., will soon be under construction. It will be one of the most complete stations of its kind in the world. Equipment and facilities for housing and caring for all types of airplanes and airships will be available.

Construction of the dirigible mooring mast will be the first unit to be completed. The U. S. S. "Akron" is expected to arrive this summer and will use the mast for the first time.

The Fokker D. XVII Pursuit Ship

Showing the Fokker D.XVII pursuit ship.

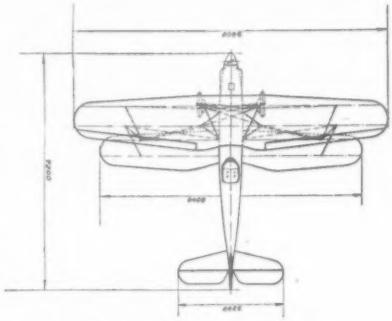
THIS new machine has been developed at the Fokker works in Holland. It is in many ways similar to the Fokker type D. XVI.—an air cooled machine produced last year—and is in fact a development of this type although different in almost all dimensions.

The first of these airplanes to be made is powered with an un-supercharged Curtiss Conqueror motor and is stated to attain a speed of 190 m.p.h. By fitting a Rolls-Royce Kestrel motor the high speed can be raised to 208 m.p.h. and by using the other alternative power-unit, the Hispano-Suiza Xbrc; the speed is raised to 214 m.p.h. without affecting the landing speed of 65 m.p.h.

The fuel capacity is sufficient for a range of 193 miles at a cruising speed of 158 m.p.h. with the Curtiss motor. The machine is the conventional type of single bay biplane except for the use of steel tube "N" struts between the wings which do away with wire incidence braces. The top wing is in one piece, while the lower wing is in two sections, each of which is hinged to the bottom rail of the fuselage.

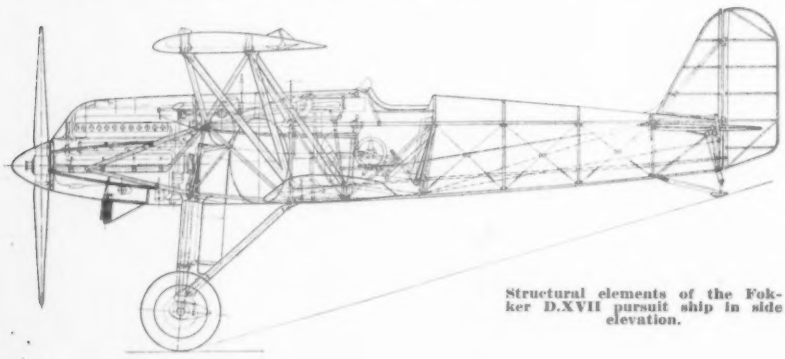
Engine cooling is effected by means of a Potts oil cooler placed under the fuselage in conjunction with a water radiator which is retractable at the will of the pilot. Equipment includes two Vickers machine-guns, navigation lights and landing flares as well as a fire extinguisher which is mounted on the engine bed for the use of the ground crew.

In general, the method of construction follows standard Fokker practice, the wings being the only wooden members. The fuselage is of welded steel tube, the engine bed being welded into one unit with the fuselage. Both wings are of wood covered with plywood.



Plan view of Fokker D.XVII.

The fuselage, back from the motor cowling, is fabric covered, as is the tail unit. The photo shown here is of the first machine of the type and the landing gear is higher than with later types.



Structural elements of the Fokker D.XVII pursuit ship in side elevation.

New Rules for Co-Pilots

AN amendment to the Air Commerce Regulations has been made, specifying that where a copilot is required in scheduled interstate air passenger services by Department of Commerce Regulations, such a copilot shall hold a Transport Pilot license. It also sets forth a method whereby pilots and copilots of scheduled air line operations may log flight time.

Existing regulations require a copilot when the aircraft capacity is 15 passengers or more; when the gross weight of the aircraft is 15,000 pounds or more, and when the pilot flies five or more hours in any one day in aircraft having a seating capacity of 8 passengers or more.

Where operation of a scheduled interstate air passenger line does not require a copilot, but should the operating company desire to carry one, such a copilot may hold a Limited Commercial license which is one grade below that of the Transport license.

With respect to the method of logging flight time, the amendment enables the pilot in command to receive credit for the total actual flight time even though he may have operated the controls only a small portion of a trip.

Under the old requirements, the pilot in command of an aircraft could log only that portion of the time during which he was manipulating the controls.

A copilot holding a Transport license may, under the amendment, log 50 per cent of the total actual flight time or the full time during which he was the sole manipulator of the controls. If that should be in excess of 50 per cent, the total time thus flown shall be certified by the chief pilot.

Gas Attacks by Plane

THE value of the airplane in laying smoke screens or making gas attacks during times of war cannot be overestimated, according to Capt. John McCoy, Chemical Warfare Service, Fort Sam Houston, Tex.

The average civilian knows little of the purpose or nature of the smoke screen, he said.

"A smoke screen laid by 'plane over an enemy artillery battery reduces its effectiveness to only four per cent," declared Capt. McCoy. "On the other hand, our own artillery fire into the smoke-covered area would be 12 per cent effective."

This demonstration was made recently at Brooks Field:

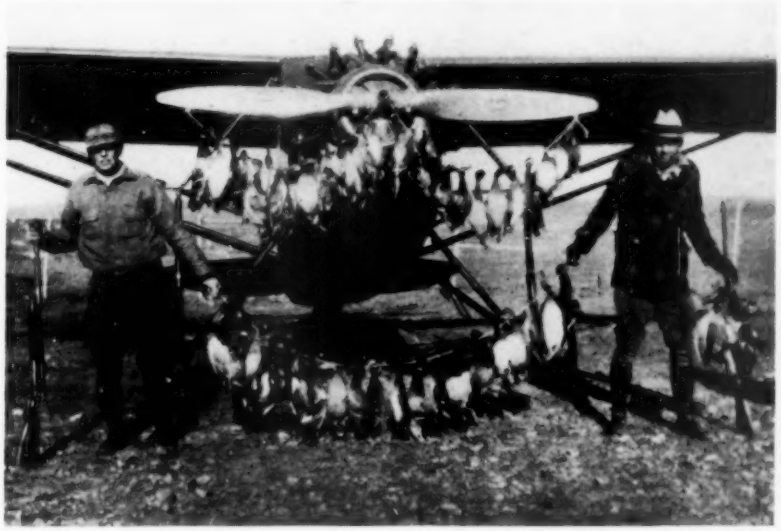
An airplane laid a smoke screen over a column of "enemy" soldiers who were not equipped with gas masks. Many of the men immediately lost their sense of direction. Veterans coughed and tears ran down their cheeks. Half-blinded by the smoke, the column soon broke into disorderly retreat.

In gas attacks, Capt. McCoy said, one airplane-load of tear gas would cover an area of a thousand square yards and eliminate an entire regiment of men.

Thrills of Hunting Game by Air

by CHARLES E. COX, Jr.*

UNLIMITED as to speed, and independent of road conditions, the author believes that the airplane will prove to be the vehicle of the future for the huntsman. Like the hawk, the pilot can quickly locate his quarry and follow it indefinitely.



Pictorial evidence of the hunters' success with the airplane in duck shooting. The ease with which the birds are followed and held within gun-shot appeals to the sportsman.

I CAN remember old Judge Spillman and my father as they sat on the porch at the Judge's Bear Island Camp, exchanging reminiscences. It was a thirty-mile trip from the Junction by team to Bear Island in those days.

"They pushed me out of my Sweetwater Camp, Charlie," the Judge would say. "Southern Michigan is fished out. Automobiles are doing it. Why, they have a road right to the old lake now, and, on Saturdays and Sundays, people drive there by the thousands. But, thank God, they'll never get here during my lifetime," he always concluded.

Speed boats race one another around Bear Island now and the Judge, valiant old pioneer that he is, summers far north of the Canadian National, laying as pretty a fly as ever, despite his seventy-odd years.

I talked to him one noon last winter, after a club luncheon. He sat by a front window in the reading room, watching the snow blowing through the gaunt city trees in the park across the square.

"Young man," he answered my greeting, "when are you going to take your father and me on a fishing trip by airplane or seaplane, or whatever you call those water-lighting airships?"

"Bless his strong old heart," I thought.

"'Do you know, sir," he went on, "two parties landed on my lake (he always called the lake where he had his cabin, "my lake") last summer. They put in gasoline and supplies and went on north two hundred miles. I can't travel by canoe any more—the portages are getting too much for me," he concluded wistfully.

"There is just one big trouble to going in by seaplane or amphibian," I said, "and that is cost. Unless a man is very wealthy, operation charges are so great that it is prohibitive. But under production," I went on, "they can get airplane travel down to the cost level of the automobile."

"To Hell with production," he snorted with his old time fire. "I hope they never get production. Why, sir, they've driven me damn near to the Arctic Circle now with their Fords and whatnot. But I have the autos whipped," he asserted firmly. "They'll never get up where I'm located now, while I'm alive!"

"Perhaps he is right this time," I thought sadly.

What will the story be? Will family amphibians cruise the north, searching for the one far lake that is unfished and unspoiled? It's been in my mind countless times in the twelve years I've been flying.

And, hunting large four-footed game is just as practical as with ducks.

I was nineteen when the war broke, but I had killed my moose, shot ducks at Corpus and gunned the Dakotas. My first use of the airplane, as an accessory to the pursuit of game, came during my preliminary training at an Italian War school during the early months of 1918. Unknown to my superior officers, a little sixteen-gauge double gun reposed in the bottom of my locker trunk. "This man's war can't be so serious that it will not allow a little upland shooting occasionally," I thought.

In flying over the level coastal plains, where the airdrome was located, I noticed that foxes were numerous. After studiously persuing my Italian phrase book, I asked my instructor in pitiful jargon if he ever hunted.

"Si, Si," he nodded. He hunted ducks (he found this word for me in the phrase book), he hunted rabbits, and, when the flight came over, he hunted quail. Later I learned what he meant about flights of quail, although at the time I thought he was pulling my leg. I continued my thought and asked if it wouldn't be good sport to fly low over the plain and shoot foxes, as they were vermin, and, as such, fair game. He pulled an eyelid down—raised his hand in a warning gesture, and walked away.

"The old army game," I thought to myself, and waited.

The next afternoon I noticed he moved my flight period to the last on the list. Once in the air (the instructor sat in the front seat of the old pusher type Farmans) he turned and held up a gun case. I was ready for my solo flight, so, as he gave me instructions to fly but seventy-five or one hundred feet above ground, I felt competent to do it.

Ferranni assembled the gun, grinned at me, and made ready.

Presently I saw a fox streaking it out of a clump of prairie shrub, and, on the instant, the Italian fired, and missed. I winked at his dejected back in a very unsportsmanlike manner. He killed two foxes that afternoon, with

* Superintendent Municipal Airport, Indianapolis, Ind.

no effort to retrieve them, and ended the expedition by chasing a hawk, finally netting it in the flying wires between the wings.

A week or two later we all broke into loud bursts of merriment when Ferranni landed and we beheld his student of the moment holding a half-grown lamb in his lap. The lamb's first airplane ride had been anything but a success, as far as the student was concerned.

The instructor's story was that the lamb had appeared lost and in danger of being eaten by foxes, so he, Ferranni, the great hearted, had landed and rescued it. The customary spaghetti odor of the Italian kitchen became an appetizing aroma, suggestive of lamb stew, the following day.

My next hunting experience via the air came in 1920 while barnstorming and oil scouting in Louisiana and Texas. I found the airplane an excellent medium to use in spotting uncharted water holes, a requisite in dove shooting which is a southern sport that somehow always disturbed my northern conscience.

Later returning to Indiana and having retained a reserve commission in the air corps, I availed myself of the equipment stationed at Fort Harrison to keep in flying trim.

White River, once famous bass water, meandered through the country north of the city and on a practice flight, I followed its gleaming trail on the lookout for ducks. I had floated down it in boyhood days with very indifferent success. The thing that had prompted my hopes that November day had been the sight of a V flight of geese beating southward high above the airport.

I flew low over the river, scanning the likely bends, but ducks were not there. In turning to fly home, I circled over a slough that had been cut out by high waters and behold up sputtered a flock of Mallards. Instead of looking at the river, I immediately began searching bayous and marking them mentally on the road map spread below. Later I had some fair shooting within fifteen miles of Indianapolis by visiting these small back waters.

Occasionally, by flying the river when the flight came down, I found ducks in abundance on the stream itself and profited by hunting in a boat the next day. I found their time on the river itself was short and was evidently a rest period after the flight from the north.

In the weeks that followed, I also discovered that quail territory was easily spotted from the air. On several occasions I was tempted to take a gun with me in the ship and land near the observed game and start hunting. The difficulty of this plan was in the fast landing speed of the plane and the small, perhaps dangerous, fields that I would be forced to use, so I held to my first method of returning to the chosen cover by auto.

(Continued on page 126)

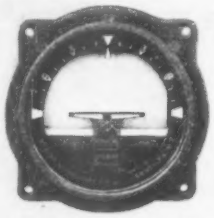
New Artificial Horizon Aids the Pilot

THE new Sperry horizon is believed to be another important contribution to the safety of flying in bad weather. It features the combination, in a single instrument, of an accurate bank indicator with the present Sperry gyroscopic horizon.

According to engineers who perfected the improved blind flying device, its chief importance and value lie in the fact that the fog-bound pilot can now not only bank with complete accuracy and safety while flying blind, but can also maintain his plane on a perfect level laterally while climbing or diving blind.

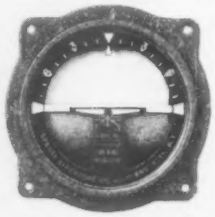
Where the horizon now in use removes most of the hazard in blind flying by simulating the natural horizon and showing the plane's position longitudinally and laterally, engineers feel that the new instrument goes a step further in coordinating this information instantly and continuously with the exact degrees of bank.

The new bank indicator appears in the form of calibrations, ranging from zero to 90 degrees on either side of the upper arc on the face of the present horizon. All that the pilot need do, since the instrument requires no interpretation, is watch the indicator as it moves through the degrees of bank to either the left or right of center. The now widely known white horizon bar and tiny silhouette airplane of the present Sperry horizon remain as before.

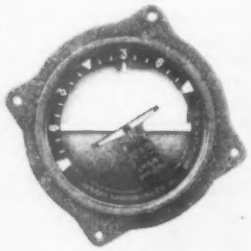


Climb-Level Laterally

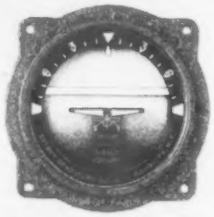
30° Right Bank



Level Flight



30° Left Bank



Dive-Level Laterally

As will be seen from the accompanying illustration, the flying altitude of the plane is indicated by the relation between a small airplane model and a white bar that extends across the dial.

The white bar represents the horizon and is maintained in a horizontal position at all times by the mechanism of the instrument.

The model is attached to the ship, and when the ship is out of the level flying position, the model no longer coincides with the white bar. In level normal flight, the wings of the model lie along the length of the bar as shown by the center photo.

When banking, the model wings make an angle with the white bar, while the divisions on the dial show the amount of bank in degrees. The pointer is the triangular white point beneath the dial and in the center. The instrument indicates either a right or left bank as shown by the two extreme figures at the left and right of the photo.

When the ship is climbing, the bar drops below the model. When it is descending, the bar rises above the model. All of these movements of the bar are governed by a combined pendulum and gyroscope.

The rotating gyroscope, by reason of its precession, maintains the bar in a horizontal position when once set in that position, but has no tendency within itself of maintaining this relation to the earth's surface.

U. S. Veteran Pilots Outfly The British

AMERICA can more than match the veteran pilots of commercial air lines in Europe. Nine veteran pilots of Imperial Airways, Britain's premier air line, during the past twelve years, have attained an average flying time of 6,655 hours, contrasted with an average of 8,600 hours of nine ranking pilots of United Air Lines New York-San Francisco route.

The greater flying experience of United Air Lines pilots is enhanced by their larger percentage of night flying, as approximately half of the mileage flown by the American group has been at night, whereas night flying in Europe until two years ago, was practically unknown. Included in the United Air Lines personnel are two pilots who have each flown 1,000,000 miles.

Late Developments in British Aircraft

by G. WYNDHAM PIERCE

England has ruled the seas for centuries, and by intensive development, is rapidly approaching a similar rating in the air. For this reason, this article will prove of particular interest at this time.

OUR most recent British military airplanes do not seem outwardly to be very different from the machines of ten years ago. But this does not mean that the performance has remained stationary.

The opposite is really the case, for the modern machines have performances which are unequaled by any others in the world,—the United States not excepted. It is true that the U. S. are a very close second and indeed they lead in some categories, but as a general rule, England has a small lead.

Among pursuit ships, the outstanding of recent productions is the Hawker "Fury," standard in the R. A. F. This machine, a biplane, has a maximum speed of 214 m.p.h. at 13,000 feet and climbs to 20,000 feet in 9 mins. 40 secs. It is very strongly and simply constructed and has been dived vertically to reach an approximate speed of 380 m.p.h. It has a water cooled V-type Rolls-Royce Kestrel supercharged engine of 500-550 h.p.

Very similar is the Fairey "Firefly" which has been sold in large quantities to the Belgian Government. Third is the Vickers "Jockey," a low-wing cantilever monoplane with a ring-cowled Bristol Mercury engine of about 530 h.p. Between 13,000 and 20,000 feet its maximum speed is 238 m.p.h. To climb to 20,000 feet takes 11 mins. These three machines have no lights or wireless but carry two automatic guns firing forward, with oxygen apparatus and cockpit heating.

There is also the Gloster S. S. 19. This machine, with a ring-cowled Jupiter engine, carries six machine-guns. Two are in the fuselage firing through the airscrew, and four are outboard on the wings, outside the airscrew disc. The lines of fire are arranged to converge to a point 200 yards ahead of the machine. This makes a very formidable fighting weapon. Its maximum speed is in the neighborhood of 195 m.p.h.

A flight of British Fairey shipboard planes just after leaving the deck of their mother ship, the H. M. S. "Courageous." This branch has been highly developed.

Like the U. S., Great Britain is experimenting with two-seat pursuit ships. One squadron of the R. A. F. consists of three Hawker "Hart" biplanes, specially arranged as multi-gun fighters, and six Bristol "Bulldog" biplane one-seat fighters. As the two types are of approximately the same performance, no difficulty is found in keeping formation.

IN day-bombers, the outstanding machine is, of course, the Hawker "Hart". This is a two-seat biplane of perfectly straight forward design. It has a supercharged Rolls-Royce Kestrel engine of about 500 h.p. It has one fixed gun firing forward through the airscrew, a movable gun in the rear cockpit, operated by the bomber-gunner, and a useful load of bombs. Its maximum speed is around 180 m.p.h., which is enough to give most pursuit-ships a good run for their money.

Among larger day-bombers, the latest Boulton & Paul "Sidestrand" has a very good performance. This machine is a biplane with two ring-cowled Bristol "Jupiter" moderately supercharged engines. Its top speed is somewhere above 160 m.p.h. and it is just as handy and manoeuvrable as a pursuit ship. Recent trials of an attack by three single-seat fighters using camera-guns on a single "Sidestrand" showed no vital hit by them, but hits on all three by the bomber's two gunners.

This machine also had an average error of less than 100 yards when dropping bombs from 6,000 feet and up, being the first machine in the R. A. F. to reach this degree of accuracy.

Among army co-operation machines there are two new types; one is the Hawker "Andax" which is a "Hart" slightly modified to suit it for its special duties in connection with ground forces. The other is a new version of the present standard R. A. F. army co-operation machine. This is the Armstrong-Whitworth "Atlas II" which has a ring-cowled Jaguar-Major radial engine. This has very clean lines and a speed of over 165 m.p.h.

An excellent side view of the Vickers "Vildebeest", an English topedo plane in full flight. Note the tremendous topedo carried beneath the ship.

ONLY one new general-purpose machine has been produced lately. This is perhaps the first machine to really justify its title. It is the Bristol 118, a Jupiter-engined biplane which can be used as a transport machine, a two-seat fighter, a day-bomber, an army

co-operation machine, or an ambulance-machine for two stretcher-cases.

Great ingenuity has been shown in its design, which might be expected to cut down performance. Yet its maximum speed is 165 m.p.h., which is not at all to be scoffed at. In this class, too, is an interesting variation of a standard type. This is the Fairey "Gordon", a variant on the well-known III F, which has an Armstrong-Siddeley "Panther" engine.

Among night-bombers, no new types have gone into service. Experimental machines have been made by Handley-Page, Vickers, and others. The Handley-Page is a biplane with two Rolls-Royce engines and a long thin fuselage slung directly under the top plane. Vickers has produced two machines, one with two and the other with four Rolls-Royce engines.

The four-engined job is very large and impressive as well as fast. There is also, rumor has it, a twin-engine cantilever monoplane in existence. England, like America, seems to be tending towards the monoplane. At present, in heavy bombers, Great Britain is far behind the U. S., but when some of these new machines are put into service, the difference may be reduced or even reversed.

Among trainers, two new types have been bought. The De Havilland Tiger-Moth is being used as a primary trainer. It is a staggered, back-swept biplane, with an inverted Gipsy III engine. It has two seats in tandem behind the center section, with deep doors. It is very robust and flyable. The other type is the Avio "Tutor," an intermediate trainer. It has a "Lynx" radial engine of 220 h.p. and is an ideal machine for its job.

Flying-boats have shown great advances. The four most recent types are: the Saro biplane A.7, which has three Jupiter engines, the Short "Singapore II" with four Rolls-Royce engines in tandem pairs (a biplane with a maximum speed of over 150 m.p.h.); the Supermarine "Southampton X" with three Jupiter engines—a biplane; and the Blackburn "Sydney", a monoplane with three Rolls-Royce engines.

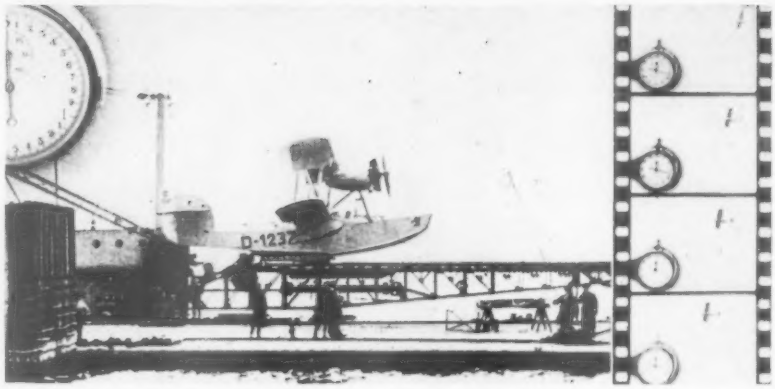
The Saro A.7 and Short boats have been very successful in extended flights to Aden and down the Nile, starting from England and returning there.

THE Fleet Air Arm has received versions of the Hawker "Fury" and "Hart", specially adapted to meet the strains of deck-flying and catapulting. These are known as the "Nimrod" and "Osprey" respectively. The Vickers "Vildebeest" torpedo-bomber is also in production for torpedo-carrying and reconnaisance units in the carriers.

The "Vildebeest" is a biplane, with a single "Jupiter" engine, and with a speed of about 135 m.p.h. It is also used as a seaplane.

This gives a short outline of recent developments in British military aviation. Except in one or two directions, progress has been very real and noticeable.

A Simple and Exact Timing Device for Flight



At the left is the stop watch, while in the center is the view of the catapult launching gear about to be timed. At the right is the composite view of the stop watch and the plane in flight, showing successive positions of the plane.

THE increased use of moving pictures for the settling of a series of questions in science, industry and sport, has frequently necessitated obtaining data not only of what actually happens, but also of the time phases within which the events being filmed occur.

In practice, such a necessity arises, for example, when testing the performance of an airplane in starting, landing and in full flight. Also in the filming of sport events when it is a question of determining high speeds.

In such cases, time in most of the cases is checked by a stop watch, either by the photographer himself or by an assistant. This is a method which is a certain cause of error since the time lag between the visual perception of the event and the muscular action involved in clicking the watch is always an appreciable length of time.

In the determination of some questions, the difference is of small importance, but the percentage of an error, however, can also be so great in relation to the taking of the picture, as when the experiment takes place too quickly for the eye to follow (in the landing and starting of aircraft) that the results obtained are of no practical use.

In consequence, we can only look upon those timings which are carried out without the aid of human assistance as being perfectly reliable. This can only be brought about by making an impression of the time on each picture simultaneously with the exposure of the film. This was first done by a very simple expedient, namely, that of placing a watch alongside the object being filmed—a projection often very inconvenient and, in certain cases, technically impracticable.

Showing how the stop watch is included in the camera's field of view.

However, a timing apparatus for attaching directly to the camera itself has been developed and has definitely solved the problem. The apparatus consists of a watch and holder, the figures of which are projected on to the film by means of a telescopic arrangement.

The holder is fastened by thread-screws on to the metal bars, which in every camera act as supports to the sun-bellows, and can be moved into a horizontal or an upright position according to the manner in which the camera is being operated. The dial of the watch can now be reproduced at any required spot on the film. The watch-holder has 3 wire-clamps adaptable to any size watch.

However simple this invention may seem, its importance to the cameraman cannot be overrated. Not only is it considerable help in the above mentioned experiments, where a perfect recording of the time of exposure is necessary, but also when it is not a question of the results being minutely exact. Even in this latter case, the cameraman is apt to find his attention divided, when the old method of timing was adopted, since both object under observation and the watch must be kept in view. With the new method, however, he can concentrate his full attention on the object and avoid any diversion in the taking of the time.

When such pictures are taken in rapid succession on movie film, they form a permanent record of the flight patch at every point and instant. If this film is retraced through a projector, the motion will appear true to life.

Photo Phans Club

WE'VE made a slight change in the name of this club in agreement with the suggestion of one of our readers—Mason D. Northrup, Chicago, Ill. Hope you like it—it's distinctive anyway.

While the names of new members are still coming in, yet they are not so numerous as in past months. Perhaps the summer season is calling you away from your hobby. Whatever it is, we'd be glad to see more activity in the club with more new names and addresses.

And here is another thought—If you fellows have an unusual warplane photograph—something way out of the ordinary run of pictures—why not send it to us for publication in POPULAR AVIATION. We will pay you $1.50 for each picture that we can use. But, please write your name and address on the back of each photograph that you send.

And now we will welcome our new members—

* * *

Lambert B. Beeauhes, 713 Reservoir St., Baltimore, Md., has been writing to our club members for some time with satisfactory results and now wishes us to enter his name, and to tell you that he is actively engaged in trading photographs. Welcome to the column!

* * *

Carl Jackson, 700 Kitchell Ave., Pana, Ill., has a number of photos and cards that he would like to sell or trade. He wishes to improve his collection.

* * *

Harry W. Aaron, 17417 East Park Drive, Cleveland, O., is an airmail collector and has a 70-page album filled with clippings, photographs and airmail covers. He is much interested in dirigibles—the U. S. S. Akron and U. S. S. Macon. He asked for the picture of the dirigible in the May issue, like many others, but unfortunately this photograph does not belong to us.

* * *

R. R. Martin, 1615 N. Western Ave., Hollywood, Cal., has many photographs for sale, 7½x9½ inches in size. He is famous for his war time plane pictures and he also has a fine collection of modern planes.

* * *

H. T. Olson, Route 3, Box 39, Inwood, Ia., has warplane photographs to sell or trade. Perhaps he has what you are looking for.

* * *

A. Kurth, Jr., 10147 Sterritt St., Detroit, Mich., is collecting photographs of wartime planes. He is particularly interested in action or combat pictures, and will quickly answer any letters that he receives.

* * *

Everett B. Gladding, 21 Everitt St., New Haven, Conn., has over 200 photographs of at least 100 different kinds of planes. He wishes to sell or trade.

New "Gipsy" Powered Four-Five Place "Moth"

The "Fox Moth" displays lines that are unusual to American productions. Note the sharp dihedral in the wings.

THESE photographs show the latest product of the de Havilland factory, Edgware, England.

This is the "Fox Moth", made to take three, or if necessary four, passengers in addition to the pilot. Luggage or freight may also be carried up to a total load of 750 lbs.

The passengers are accommodated in a roomy cabin which is placed below and just forward of the wing center section, and the pilot is placed in an open cockpit just aft of the cabin. The view from the pilot's seat is particularly good on account of the raised position of his seat and the tapering forward of the fuselage.

There are two large doors to the cabin, one on either side of the machine, and these give easy access to the hammock type seat at the rear of the cabin which is designed to take two passengers.

Forward of this hammock seat there is another seat of the single bucket type which is arranged so that it can face either to the front or the rear of the machine. This seat can be removed and replaced by another, although only temporarily, which will accommodate two passengers.

The equipment of this machine is very complete, including, as it does, an air heater, a telephone, sliding hatch for communication between passengers and pilot, and the provision of two lockers in the cabin which may be used as tables during flight or lifted out and used as carrying cases when the machine is at rest.

One feature of the Fox Moth which is of great interest is the interchangeability of a number of its components with those of other machines made by the same company. The wings, if modified very slightly, are interchangeable with those of the D. H. "Tiger Moth," and the complete engine installation, including cowling, engine mount, etc., is identical with that used on the "Tiger Moth" and "Puss Moth" aircraft.

The tail assembly is also interchangeable with those of the "Gipsy Moth" and "Tiger Moth" machines. A standard engine, the 120 H. P. inverted "Gipsy" similar to those fitted to other models of the de Havilland range, is the power unit of the "Fox Moth."

At the right we see that the pilot, seated in the open cockpit, had an excellent field of view.

* * *

Below we see the "Fox Moth" in full flight.

16 Official Photographs

Here are official government photographs of celebrated Allied aircraft, many of which have not been previously published

SPAD TWO SEATER

LEPERE

DEHAVILAND-4

BREGUET

FARMAN

CAPRONI

VOISIN

CAUDRON

Official Photos
U.S. Army Air Corps.

France is represented in the above group of photographs by the S. P. A. D. two-seater, the Lepere two-seater, the Breguet bomber, the twin-engined Farman, the old Voisin pusher and the Caudron. The DeHaviland-4 (D.H.-4) was used both by America and England, while the Caproni biplane was exclusively Italian. Several Lepere planes were built in the United States by the Packard Company shortly after the war and were reported to be "sweet ships".

# of Allied War Planes

Several of the airplanes shown below were used only to a limited extent during the war, and pictures of them are rare indeed. Notable examples are the Morane and the Salmson

MORANE

SPAD

SOPWITH DOLPHIN

BRISTOL FIGHTER

NIEUPORT

SOPWITH CAMEL

S.E.5

SALMSON

Official Photos
U.S. Army Air Corps.

At the left (top) is a French Morane monoplane of the parasol type. Beside it is the French S. P. A. D., a contraction of the firm name—"Societé Pour Aviation et Derivee". The Nieuport and Salmson are also French airplanes. English warplanes are represented by the Bristol Fighter, Sopwith Dolphin, Sopwith Camel and the "S.E.5". The American forces used nearly all of these planes at one time or other, but the S. P. A. D. and Nieuport were the most commonly used.

Talking Through Light Beams

Talking through a light beam from the Los Angeles.

A NEW means of directing speech and signals through an invisible beam of ultra-violet light has been developed and tested by John B. Taylor, engineer of the General Electric Company.

This is superior to radio in many respects for the transmission of secret messages between two points for the reason that the beam is narrow and difficult to pick up, and requires special apparatus for receiving the message.

Mr. Taylor successfully carried on a conversation for 15 minutes with the ground station while in the U. S. S. Dirigible "Los Angeles," 2,500 feet above Schenectady, N. Y.

Model of Transatlantic Plane

HERE is the model of a seaplane which its inventor, Capt. Hugo Sundstadt, claims will cross the Atlantic from New York to London in 26 hours. Construction of the full sized ship will soon be started.

The plane, called the H. S. 320, will carry a crew of four and 2,000 pounds of mail. Its speed is estimated at 170 m.p.h. For coastwise service, the plane could carry 24 passengers.

Capt. Sundstadt is shown holding a model of his airliner.

Howl Department for Amateurs

YES, that's just what it means—the Howl Department—and it is to be devoted to the best interests of lightplane builders, glider builders and amateur aviation in general, with special reference to combatting fool obstructive and restrictive legislation.

If you or your friends have a kick to register against the late regulations issued by the Department of Commerce or against the laws recently inaugurated by the various state legislatures, then this is the place to register it. Very likely it will do some good.

You will agree that the logical editor for this department of howls, kicks and spasms is our old friend Cap Purcell, but we won't give it to him. Let him start a professional pilots' howl department of his own.

What we want—and don't misunderstand us—are howls on the subject of adverse legislation—not by amateur howlers, either—for if ever a good professional howler was needed, this is the time for him to begin his lamenting.

In reply to many inquiries, we wish to remark that we have not yet published any petitions for this purpose for the reason that we do not yet have a sufficient number of opinions.

Now, by good fortune, we have a number of letters available to start out with—letters that will give you a good idea of what we are driving at. We want your suggestions as well as criticisms as to how this continual meddling by governmental bodies can be ended. Here we go with our first letter from Stanley Rowan, 1826 S. Michigan Ave., Chicago, Ill.:

Dear Editor:

After reading your "Airy Chat" in the July issue of P. A., I figure that now is just as good a time as any to express my opinion. I was taught in high school, in "Problems of Democracy", that Federal law supersedes State law. In fact that is stated very plainly in the Constitution.

Aeronautics Bulletin No. 7, which is a federal publication, says in Chapter 1 Section 2B, "Aircraft used solely for pleasure or noncommercial purposes need not be licensed, although engaged in flying between States," etc. In the face of all that, I don't see how the States have been getting away with their various laws to the contrary.

It looks to me like this is just another racket which has got a hold on the industry, and I am for any plan or idea which you think will abolish it.

When I came to Chicago, almost three years ago, it was to go to an aviation school. I was taking a mechanic's course and it cost $250. The school went bankrupt not long after I had all my tuition paid. I was then left without a tangible thing to show for the money spent—not even the ability to weld, which I was supposed to get. This is racket No. 2.

When P. A. started to publish directions to build a Heath Parasol, I said, "There's my chance", and nailed onto it. Just about the time I got the kit all paid for, the States began passing laws ruling that home-built planes could not be flown within their boundaries.

*In the majority of cases that I have heard and read about, these laws seem to be aimed more at the Model * * * * plane than any other make of ship, and that is just why it looks to me like another racket. Just why they should show so much concern about a single-place sportplane is certainly beyond me.*

I think it's fair enough that all lightplane builders be required to equip their planes with a fire extinguisher, fire wall, safety belt, tachometer, oil gauges, altimeter, etc., and to prove by a licensed mechanic that they have done a good job in constructing them.

An idea just now popped into my head. I notice that Senator Bingham of Connecticut was the one to introduce the bill for Free Civilian Air Training. Now then, why couldn't the lightplane fans get organized the same way and get him to introduce a bill for us?

With a magazine like POPULAR AVIATION *for an organizing medium, we should be able to put it across.*

Yours truly,

Stanley Rowan.

This is another slant on the subject in which we get down to basic principles of Federal Law and the Constitution. Bulletin No. 7, the final authority, very clearly ignores any idea of state rights, just as Mr. Rowan points out. Thanks, a lot.

* * *

JAMES GREEN, Route 1, Walla Walla, Wash., now comes to bat with some pertinent paragraphs regarding amateur aviation. He is right up and coming on taking immediate steps toward rectifying matters, as you will see by his letter:

Dear Editor:

That article by Leslie Long on "Laws That Affect Amateur Aviation", is sure good but say, why not do something about it except talk? Let all interested in amateur aviation send in fifty cents or a dollar and hire an attorney to help change the laws. I'll do my bit.

Perhaps your petition referred to on page 346 is for amateur aviation; if so, send me a dozen blanks and I'll get them signed. I couldn't find a copy of the petition in the magazine. Why not publish it?

I have had about eight months' experience toward getting a mechanic's license and have about 12 hours' dual coming to me on a plane that I am working on now. I'm taking my pay in flying.

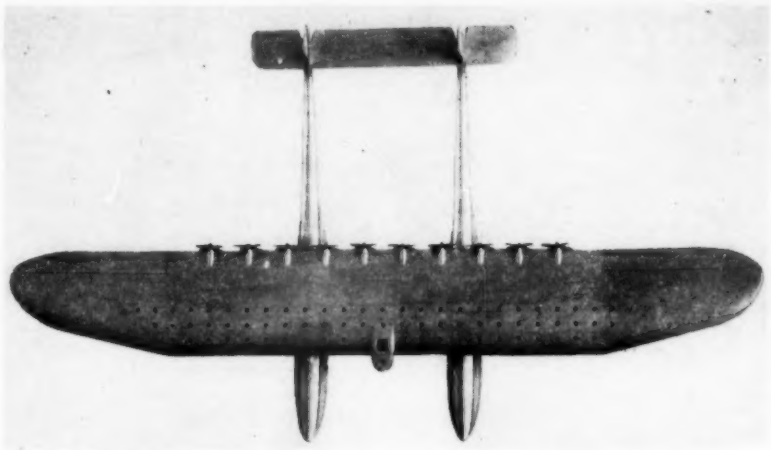
I plan on building a two-place ship this fall. I am going to copy the Lockheed Vega as near as possible.

(Continued on page 133)

The Rumpler 171-Passenger Transport

by HANS F. KUTSCHBACH

AN INTERVIEW with Dr. Rumpler, one of Germany's earliest and best known aeronautical engineers, in which he divulges the details of his new transatlantic airplane now under construction. The Rumpler will be one of the largest airplanes ever projected and will make the Do-X seem puny in comparison.



A plan view of the Rumpler Transatlantic airplane showing its powerplant of 10 engines, the double hull structure and the peculiar wings.

WISHING to attain the latest information on the Rumpler Ocean Liner, which has awakened so much interest in Europe, I decided to interview Dr. Rumpler, believing that our acquaintance, dating back from the early days of aviation, would lead to a more detailed account of his new marvel than had been given to the press.

A I suspected, Dr. Rumpler still has his early Zanonia leaf theory in hand on this new ship, and our conversation soon brought out this fact as his memory went back to the old days. The rest of the interview will speak for itself and needs no further introduction nor explanation.

K. Dr. Rumpler, do you often recall your first flight over the Rhine in 1911?

Dr. R. Yes, I often think of those wonderful times.

K. When you crashed near Mayence, were you hurt?

Dr. R. No, I had only a few trifling injuries, but I am surprised that you know about the accident.

K. At that time, my dear Doctor, I learned to fly an Aviatik biplane near Mayence, and was there when you made the first flight over the Rhine in your monoplane. I was one of the first to reach the monoplane after it crashed, but you had left shortly before I arrived.

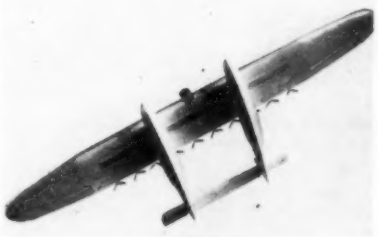
Dr. R. Yes, that was my first monoplane.

K. Is the construction of your new ocean liner based upon this model?

Dr. R. Yes. It is not only based upon that first monoplane, but it is also based upon the properties of a grain of seed.

K. Is that so? Please tell me how this came about.

Dr. R. Well, it is very simple as



A three-quarter view of the Rumpler from below.

with all great inventions. The wing construction of my first monoplane was copied from the tiny seed of a palm tree, and now this tremendous ocean air-liner will also be copied from the wings of this tiny seed.

The wings of this seed are ideal carrying surfaces, I recognized this from the first, and it would seem that it has taken the palm tree thousands of years to develop such a perfect surface for carrying the seed long distances in stable flight. The seed is a perfect glider, its wing form is perfect as well as the distribution of the weight along the surfaces.

K. You have studied the seed of the Zanonia Macrocarpa very carefully, Doctor, to arrive at such conclusions.

Dr. R. Yes, for many long years I studied this seed, and finally came to the conclusion that I would take advantage of Nature's long experience, by copying the seed. You must know that the seed grain itself is centered exactly in the center of the wings so that the weight of the seed is practically in one spot.

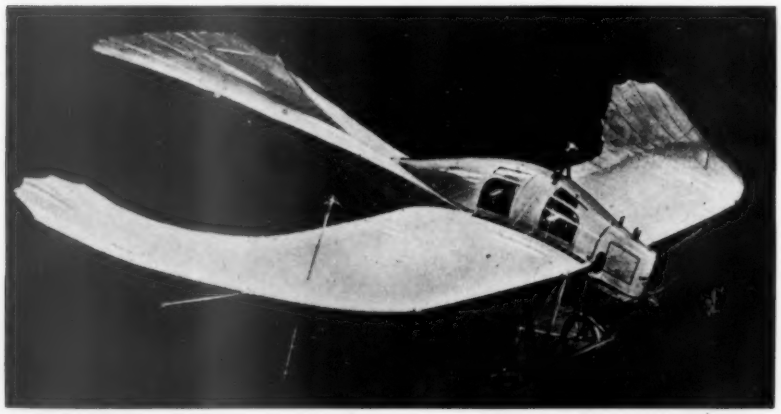
Dingler, who brought one of the seeds from the Isle of Java, has shown that the total weight of the winged Zanonia seed is 177 milligrams, 147 milligrams of which are concentrated into the exact center of the wings.

K. This is very interesting. How is it possible?

Dr. R. This is only made possible by having the wings very thin and light, for only 30 milligrams out of 177 milligrams is represented by the wings. The weight is tied back into the wing surfaces by tiny threads, strong but light. The wings are slightly convex at the bottom and the tips of the seed's wings toward the back are turned up.

K. And what is the advantage of this?

Dr. R. This provides the seed with an extraordinary flying ability, giving equal resistance at all points and great



An early pre-war Rumpler "taube" with the distinctive Zanonia shaped wings. Note the swept back wings and the upturned wing tips, modeled after the Zanonia seed.

stability. The flow of air is uniform and orderly.

K. And so the airliner will be built from this seed as a model?

Dr. R. Yes. All my former planes were based on it, and they were so successful that I intend to retain the principle.

K. Let us have some more information on the airliner.

Dr. R. Well, she will be a double hulled seaplane of mammoth proportions. She is so designed that the weight, like the weight of the Zanonia seed, will be located as in the seed. To attain the proper weight distribution it was necessary to use many small engines rather than a few large ones. Altogether there will be ten 1,000 h.p. motors giving a total of 10,000 h.p. This gives about 40 per cent surplus power at the beginning of the trip, or 60 per cent surplus power near the end of the trip when most of the fuel load is exhausted.

K. Where are the engines located?

Dr. R. They are located within the wings and along the rear edge. The passengers and crew are located within the leading edge of the wings, in front, where the view is better.

K. How are the passengers accommodated?

Dr. R. The wing space is divided into compartments, and the depth of the wings will be great enough to give sufficient headroom for comfort. There will be six seats in each of these compartments, and they will be lighted by bulls-eyes in the ceiling or in the top of the wing.

To avoid annoying the passengers by the noise of the engine directly to the rear of them, a wide passage will be constructed along the middle of the wings, and between the passenger compartments and the engine compartments. This passage is also used as a promenade.

K. How many people will the airliner carry, Doctor?

Dr. R. The airliner is designed to carry 136 passengers and a crew of 35 men. The wings are reserved for the passengers and crew while the fuel and oil will be carried in the hulls, this arrangement avoiding all disagreeable odors of gasoline and oil in the passenger division.

This arrangement has other advantages as well, one of them being that there is less danger of fire and that the center of gravity is much lower than in the case where the fuel is carried in the wings. Every inch of space is utilized by this method and that is a very important point in the design of an ocean liner.

K. What is the advantage of pusher propellers behind the wings?

Dr. R. The propellers, when in this position, act upon the wash or wake of the wings, thus adding considerably to their effectiveness. The wings drag air after them, and then the propellers act upon air which is travelling in the direction of the ship, increasing the spread and conserving power.

A Demonstration of Automatic Stability

At the right is the Cornelius ship showing its peculiar wing structure.

* * *

Below, the automatically stable plane is shown in flight with its pilot's hands off of the controls.

AFTER much experimenting, W. G. Cornelius recently gave a public demonstration of the "Free-wing," an automatically stable airplane of highly original design.

Cornelius claims that his ship can easily fly three hours—or longer—without the necessity of touching the controls, and that the ship can be landed safely without the use of controls.

While not much data can be obtained concerning the design, yet it is definitely known that the performance is due to "free-winging," that is, to the support of the wings by freely pivoted supports so that they can readjust themselves.

A New Type of Muffler for Airplane Engines

A MUFFLER for airplane engines which reduces noise approximately 70% and at the same time reduces back-pressure by one-third has been developed by and is in use on the airliners of the Eastern Air Transport System, it was announced recently. The planes using the new device fly between New York, Atlanta and Jacksonville.

Ralph G. Lockwood, chief engineer for Eastern Air Transport, made public a report on the device recently. It was designed and developed under his supervision and has been in service for three months on three of his company's de luxe 18-passenger Curtiss Condors. It has now been officially adopted and will be installed on each Condor. This is believed to be the first time a transport company has developed a successful muffler for use on its planes.

There is one muffler for each engine, and the exhaust gases from both manifolds are run through it. The muffler's interior is in the form of a stationary screw which spins the gases, causing them to travel an additional 48 feet before being released into the open air, and providing two and one-half times the former cooling area. The result is a 70% decrease in noise volume and at the same time a reduction in back-pressure. His statement follows:

"Under instructions of Capt. Thomas B. Doe, president, and H. A. Elliott, vice president and general manager, I was detailed to develop some method of decreasing the sound of the Condor's 625-horsepower engines. A study was made and the size of the exhaust manifolds and mufflers was determined. In order to eliminate weight, the exhaust manifolds were constructed with all exhaust gases to be carried away in one manifold.

"The size of this manifold is two and one-half times as large as the old type manifold. This permitted the exhaust gases to expand and the back pressure was lowered about one-third.

"In gathering the exhaust gases into one manifold, it was only necessary to install one muffler per engine. The experimental mufflers were made of a special iron which was found to be able to withstand heat and vibration. Baffles were inserted on the inside of the muffler for the purpose of spinning the exhaust gases.

The mufflers were found to deaden the sound of the engine considerably and with the information which has been obtained from the experimental mufflers, we expect to develop a cast aluminum alloy muffler which will be lighter and more durable than the present type."

There is no doubt but what the efficiency of an engine can be increased considerably by reducing the back-pressure.

How an Autogiro Flies and Why

by STUART E. KNUEPFER

Just how the "flying windmill" operates and how it feels to fly in this latest aircraft. Mr. Knuepfer made a trip to the Kellett factory for POPULAR AVIATION to obtain material for this article.

WELL, here you are, all ready for a ride in an Autogiro. Queer looking ship with its enormous rotor blades and the upturned ends on the wings. Before you ask any questions, however, the pilot is going to take you up and we can go over the "ground work" after you've had the ride.

Here he is—all right—climb in. In this model, the Kellett, you and the pilot will sit side-by-side. Now that you are comfortably seated, you can see that the Autogiro is just like an ordinary airplane at least from the interior appearance. Guy Miller, the pilot, primes the motor and with the use of a self-starter, the power plant gets under way.

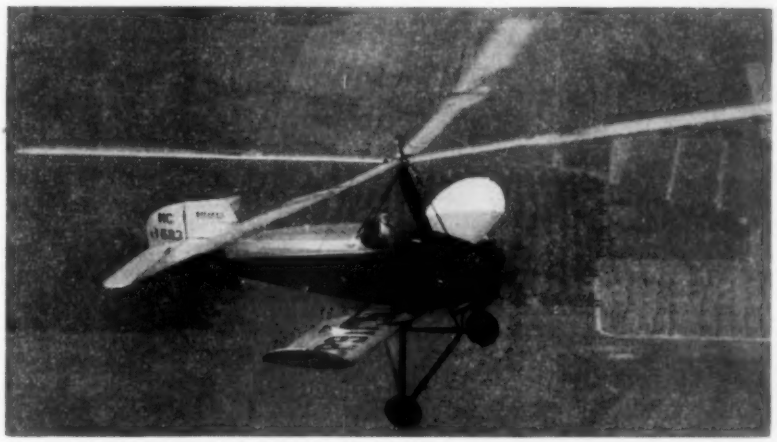
After a short period of warming up, his left hand reaches for a clutch which will start the rotor into action. Now you can look up and watch the great blades revolving around your head.

Miller revs the motor and taxis into the wind. Don't become impatient because he looks carefully around to see that no one else is either landing or taking off, for you will soon find out why he uses this extra bit of caution.

At last we're all set and he gives it the gun. Whoops! Feel the ground slipping from you? Faster and faster until you feel like wiping your brow with a handkerchief while wondering what giant finger picked you off the earth like that.

Well, that was only the rotor blades doing their bit. Now, you begin to understand why, because of the steep ascent, the pilot watched for other ships. As you rise, keep one eye peeled on the altimeter and speed indicator for you might have occasion for some additional wondering within a short while.

A close-up view of the pylon showing the starting gears at the apex of the pylon and the driving shaft used for starting.



An Autogiro in flight showing the four bladed rotor and the short, stubby wings used for assisting the rotor in lifting the load. Note the upturned wing tips to insure stability.

IF YOU have been watching the overhead blades you will see that they constantly revolve at practically the same speed. Your altimeter now reads 2,000 feet and the speed indicator is on the 85 mile-per-hour mark. Miller touches the throttle and the indicator sweeps slowly down until it reaches the 50 mark . . . 40 . . . 30 . . . 20 . . . 15 . . . 10 . . . 5 . . . what's this? . . . you're hanging motionless? No, your eyes are telling the truth and the plane has lost all forward speed.

The rotor blades are now performing the highly important duty of sustaining the ship even though the altimeter is swinging down to a lower point. In other words, you are dropping to earth in much the same manner as that of a parachute jumper. Miller opens the throttle, pulls back the stick and away you go to the higher strata. And climb? The plane reaches for greater altitude the way that you run a long flight of stairs and in practically no time you are back where you started.

Well, that was an experience. Now for a combined steep left bank and climb. Think you're going to do a wing-over? Not quite, although the thought of spin is still in your mind. Needn't even worry about that because those faithful blades are going to hold the ship in the air and prevent any such mishap.

With the ship again on an even keel, Miller throws open the throttle to its full capacity and the hands jump to 105 miles per hour as he heads into the wind. Have you noted the absence of jars and vibrations? Here again the overhead blades are removing all the uneven bumps which would otherwise pass through the ship to you. However, it's time to be alert because the airport is taking shape beneath you and you will soon be on earth.

MILLER is able to land in a glide, vertically, or with a combination of the two, a landing and slight roll. He chooses the latter because his ship will operate to its best advantage with this type of landing. The throttle is slowly closed and once again the almost imperceptible drop is started. Since you're not going to miss any of this, your eyes are glued to the ground and the earth is rushing up at you. Miller's hand is on the throttle and he manipulates it in order to pick out the very spot he wants.

Another vertical drop, the motor roars, quiets and the wheels bounce on the ground. The roll? About twenty feet isn't it? After a short taxi to the hangar, you notice Miller's hand reach up to pull back the same lever he started the rotor blades in motion with. It now becomes a brake and the giant blades droop to a complete stop. There you are. Climb out and let's go inside the hangar to do the ground work.

Juan de la Cierva, a Spaniard, is credited with the invention of the Autogiro principle in 1920. He, like many other inventors, was striving to eliminate the dangerous stall which is not uncommon to airplanes in general. Cierva discounted the theories advanced by those who had evolved the heliocopter and "flapping wing" ships and de-

cided to try a series of experiments which would give him an airplane with rotating wings instead of the stationery kind.

He worked long and ambitiously with his dream and, in 1923, made a successful flight over Madrid, Spain. The interest in his ship spread rapidly, but he was to spend an additional two years in ironing out many of the defects he felt still remained in his creation. America saw the first Autogiro in 1928.

UPON investigation, there is nothing extremely complicated nor fantastic in either the principles nor construction of the ship. Its most remarkable feature is that it displaces a large volume of air in a short space of time.

In the ordinary fixed wing type of aircraft, you understand that the speed of your plane determines the amount of air that strikes the surfaces of the wings and, in this manner, determines the amount of weight the wings will carry.

This air creates a lifting force by striking the heaviest part of the wing first and then rapidly following the downward curve of the aerofoil surface. In like measure, the faster the plane's speed, the more air it flies through and the greater resultant lifting pressure created on the wing surfaces.

Now, if the wings are free to rotate, they are able to provide the same solid support because of their high speed of rotation through the air. The Autogiro has four large blades which are in constant revolution. They act as wings and create a comparatively great supporting force by moving in a compact body of air and performing exactly the same duties of fixed wings. Instead of a straight line of "air" flight, therefore, you have a cycloidal line of "air" flight.

The rotor system of the autogiro consists of a set of four hinged blades—also termed as rotating wings—mounted on a hub and connected by a system of check cables. The hub rotates on ball bearings which are set on a pylon structure, directly above the fuselage.

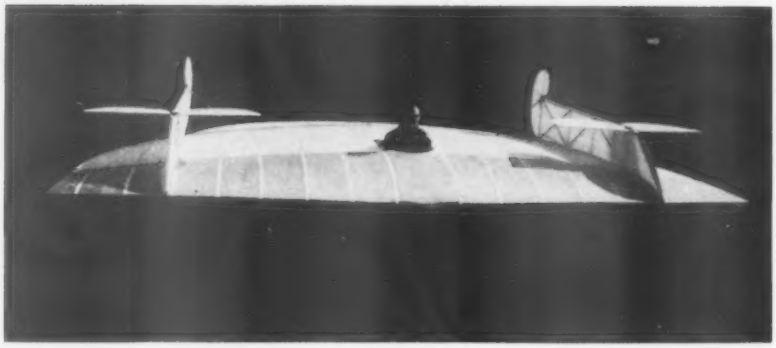
To provide against any failure here, the bearings are multiple in number and are mounted to permit free rotation of their races in their housings in case of ball or rotor failure.

THESE blades rotate freely under the pressure of the wind which is produced by movement of the machine.

They receive their original starting rotation from a self-starter which is connected to and derives its power directly from the engine crankshaft. The clutch you saw the pilot release to start the blades, controls this self-starter. The blades work up to a desired speed in less than sixty seconds and, once started, they do not receive any more power from the engine but operate purely from the air streams

(*Continued on page* 127)

And Now Comes the Dirigiplane



Front view of the Snyder Wingless plane with the inventor sitting in the cockpit. Note the control surfaces.

THE "dirigiplane"—a tailless and fuselage-less aircraft, the invention of Dr. Cloyd L. Snyder, 822 E. Ewing St., South Bend, Ind., is a unique airplane that has successfully flown in glider form.

Colonel Clarence M. Young, assistant secretary of the Department of Commerce in charge of aviation, in a recent visit to the city, witnessed the flight of Dr. Snyder's glider and was enthusiastic over its performance.

Vincent Bendix, of the Bendix Aviation corporation, also witnessed the demonstration, and with Col. Young was likewise impressed by the craft's performance. The dirigiplane is the result of five years' experiments with small models by Dr. Snyder and is a craft of radical design.

It consists simply of a single broad foil to which is attached tail fins. Tails and fuselage, as they are known in the present day planes with their struts, braces and other accessories increasing wind resistance, are done away with. Everything, including the plane's motors, are to be enclosed in this airfoil which gives the craft the appearance of a devil fish.

Dr. Snyder's model which he has successfully flown, is now non-powered but is large enough to carry a pilot weighing 200 pounds when equipped with a power-plant.

It has all the controls of a regular ship. It is 20 feet long, 13 feet wide and the foil is 14 inches thick. Dirigiplanes, built as power units, will be much larger, according to the inventor. He visions a plane with a span of 320 feet which will be powered by many motors and which will have enclosed compartments to meet every need of the plane's crew and convenience of its passenger. With such a plane, Dr. Snyder believes, non-stop flights around the world are not improbable.

The main advantage of the ship is its low take-off and landing speeds. Dr. Snyder's non-powered model has landed and has taken off at speeds of as low as 30 miles an hour. On several occasions it has been landed at 5 miles an hour and has been stopped in five feet. Powered planes of this type will land proportionately slow, Dr. Snyder says.

The dirigiplane can be inflated with gas with enough power to lift a good share of the weight, Dr. Snyder says. However, for any ordinary purpose, gas would not be considered and all tests have been made without the use of gas. Dr. Snyder has successfully flown his ship many times and is preparing next to build a powered model.

An Aerial Observation Car

THE latest addition to naval aeronautics, an aerial observation car, has been delivered to Lakehurst, N. J., for installation in the U. S. S. Akron. The device, constructed in secret at Akron, Ohio, is new to American aviation, and it is expected that the Navy will conduct secret tests before giving the public an opportunity of viewing the novelty.

The small car, carrying only one member of the Akron's crew, will be lowered, by means of a slender cable, nearly 2,000 feet while the airship cruises above in the fleecy ceiling. The observer in the sub-cloud car is in a position to telephone instructions to the commander and thus indicate vulnerable spots for bombs.

The observation car is so small that it would be practically invisible to scouting planes or searchlights. And even if it was sighted, a hurried message would draw the car up into the huge envelop.

In appearance, the sub-cloud car resembles an airplane fuselage without wings. It is just large enough to carry one man, together with telephone instruments and maps. It is believed that the car will be equipped with a parachute and a collapsible boat. With this equipment the observer could bail out in case he was fired upon by an attacking plane or an anti-aircraft battery. If it becomes necessary to resort to the parachute over water, he could float on the surface.

Battling Aerial Bootleggers

by GLENN J. CHURCH

An Actual Encounter at the Canadian Border

THRILLING as a war-time battle story is this story of an encounter between a government combat plane and the guardian plane of a bootlegger's aerial forces. A Kelly field machine-gunner is called upon to assist the police planes and victory results for the law. See the cover illustration.

The police planes operated by the city of New York for patrolling the air and the highways. Supplementing these planes are the New York state aerial forces.

"I THOUGHT the war was over, Major," I chuckled as I finished reading a telegram just received from the Department of Aeronautics headquarters in Washington. "The only machine-gunning I've done since '18 has been target practice with a camera mounted on the gun swivel."

"But orders are orders, Lieutenant Patrick," Major Leflin replied. "Looks like a wild goose chase to me, but they want the best machine-gunner at Kelly Field . . . so that means you. Your plane and pilot will be ready at seven in the morning. You will report to the Chief of Prohibition Enforcement, State House, Bismarck, North Dakota."

"Yes, sir," I answered, "I'll be ready promptly at seven."

Mechanics worked until dawn getting our fastest Boeing fighter in tip-top shape for the job. In place of the harmless camera, a shining new Browning machine gun was fitted into the swivel of the rear cockpit. Every detail was checked and re-checked carefully. Shortly before seven, the plane was rolled out of her hangar, the engine started and slowly warmed up for the flight.

Captain Hargrave, who served with the 7th Aero during the War, was selected as my pilot. Just before we climbed into our cockpits, he put his long arm around my shoulders and whispered into my ear, "How many Fokkers is our quota today?"

"Bootleggers, not Fokkers!" I corrected him, laughing. He smiled but did not reply. I could see hard lines setting around his mouth, just like my old pilot used to look before we would hop off for an aerial encounter.

After final instructions from Major Leflin, we were Bismarck bound. The fleet combat ship made excellent use of the slight wind at its tail most of the way and we made the trip in six hours.

EVIDENTLY our arrival and mission had been kept a secret, for no brass bands nor eager crowds were on hand to greet us when we set down at Bismarck. In fact, the Chief was so eager to get down to business that he almost overlooked our half-starved condition . . . until we diplomatically suggested how much better we could go into conference with some food for thought.

"Conference" is hardly the proper word for what we went through when the Chief started unburdening his troubles. It seemed that Canada's well-patrolled border was no longer a handicap to really ambitious bootleggers. They were flying liquor across . . . and not only that but they were escorting their transport plane with a smaller plane equipped with a machine gun!

Their trips were made at night . . . where to, no one knew. Somewhere in the sparsely settled regions of northern North Dakota, the bootleggers had a secret landing field, probably camouflaged by appearing as an ordinary farm. From here, the liquor was distributed by truck to various points inland.

Verification of this well-organized plan had been made by a pilot on the Canadian Air Transit lines who said he had seen the huge transport with its small bodyguard heading due south on several occasions.

"These racketeers are a tough bunch," the Chief warned us, "Evidently they are prepared for the worst."

"Do we get to capture them dead or alive?" I asked, half jokingly.

"You'd better take them dead," the Chief replied seriously, "before they take you."

FROM his desk, the Chief then took a very carefully drawn map of the border region, showing the approximate point where the liquor transport crossed into the United States and where the trap was to be laid. "We have an improvised landing field here," he said, "with an old barn to serve as a hangar and a powerful searchlight hidden in another old building. Still another shed houses a radio transmitter and receiver for communication with the planes.

"Our plan is to have two police planes scouting in this territory around the time we expect the transport plane to come over. When one of our planes sights her, it will notify us by radio. Then you men will take-off from here and by the aid of our searchlight we hope you can locate the transport and small armed plane accompanying it."

"Sounds easy," I replied. "Then do we open up and bring down the enemy?"

"Not at all! Not at all!" the Chief exclaimed. "First attempt only to follow the transport—all the information we need is her destination. However, if you are fired upon, I authorize you to use your good judgment in proceeding."

The Chief was versatile, he even had a fair knowledge of the almanac. "A full moon rises at 6:30 tomorrow night and sets at 3:30," he informed us. "That should be of some help to us."

"Also to them," put in Hargrave. "Targets are always easier to hit with some light on the subject."

"Works both ways of course," I hurriedly explained so that the Chief would not suspect our doubting the excellence of his plan.

"We have everything in readiness for

(*Continued on page* 126)

Can Man Propel Himself Through

Very recently, the German glider pilot, Hans Richter, has been making short hops with his winged bicycle. The wing span is 19 feet with an area of about 75 square feet.

by

W. I. OLIVER

Noted student of aviation history and ornithopter fleight

AS FAR back as the history of the human race extends, there have been men to whom the conquest of the air appealed with alluring force. Every age and nearly every land have their legends of flight and of flying men.

And in the most part, these early dreamers, attempted to emulate the flying birds and to sustain themselves in the thin air by the exertion of their own muscular power. It was not until a comparatively recent date that man conceived the idea of employing forces other than his own physical effort in flight.

First of all, we have Icarus of ancient mythology and his father Dadaleus, who assisted their muscular efforts by a magical wax used for fastening the feathers to their bodies. Incarus, according to the poet, steered a course too close to the sun, and in so doing, melted the magic wax and performed the first stripped wing stall in history.

In these early conceptions of flight, the ornithopter or flapping wing flight was naturally the most popular since this was the nearest approach to bird flight. It seems strange that the use of fixed wings or reverted gliding flight did not occur to the minds of the early investigators until the early part of this century and yet all of these men must certainly have observed the soaring flight of the seagull, eagle, condor and other soaring birds.

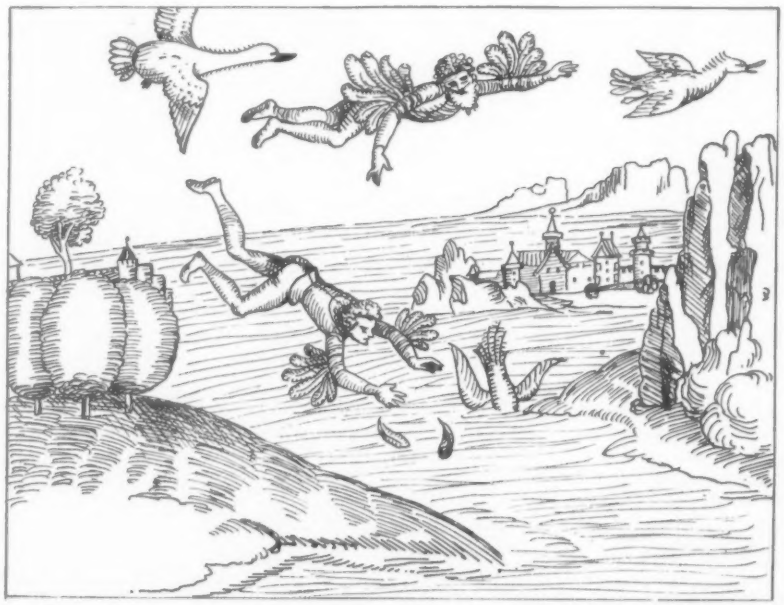
And even with our own greatly improved technical knowledge at the present time, we have not yet achieved flight to any great extent by muscular effort alone. To be true, some few short hops of from ten to twenty feet have been made by muscular effort—but not continuously sustained flight of any practical import. And yet, by a comparatively slight improvement to the airplane as we now know it, it is possible that muscular flight could be maintained for comparatively great distances.

Unfortunately, as pointed out by Octave Chanute and others, the amount of power developed by the muscles decreases in proportion to the weight of an animal or bird when the weight increases. In other words, large animals or birds cannot fly—at least by the flapping wing method—as successfully as small birds. Finally we arrive at a weight or size beyond which flight is impossible.

FORTY years ago, Chanute pointed out that the energy developed by a bird increased as the square of its dimensions while the weight increased in proportion to the cube of the dimensions, or many times faster. Thus, if the size of a bird or animal is doubled, its power will be increased $2 \times 2 = 4$ times, while its weight will increase as the cube or; $2 \times 2 \times 2 = 8$ times. Thus, the available power for lifting the weight in flight is only half as much when the size is doubled. And this idea seems to work out in practice so far as direct lift or flapping wing flight is concerned.

As a practical example of this condition, let us picture a sparrow and an eagle in a pen. This pen has no top, is 40 feet square and has a wall height of four feet all around. The small sparrow rises vertically at the rate of nine to 10 feet per second and could easily clear the walls. The eagle, on the other hand, could not escape because the eagle requires a wing flapping run of 60 feet to clear the four foot fence. In short, the large and heavy eagle has less power per pound of weight than the sparrow according to the law just mentioned, and because of its reduced climbing ability cannot "take-off" so quickly.

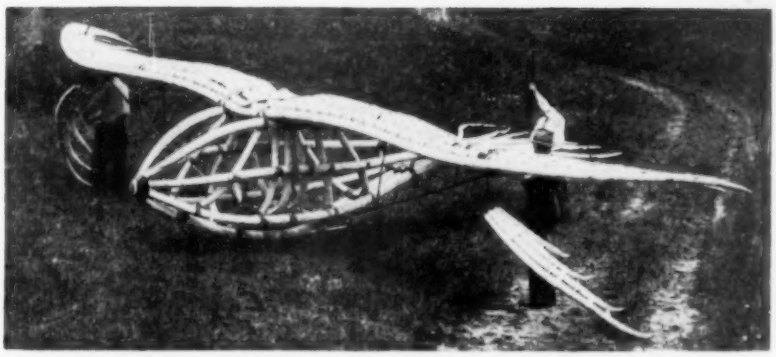
And the same rule applies to the



Daedalus and Icarus. Icarus fell into the sea, but his father Daedalus flew on and reached the mainland.

the Air by His Own Power

WHILE little success has been attained in muscle-propelled flight after centuries of effort, yet the idea is not wholly impossible. If the efficiency of the present wing-section were doubled, then the project would be successful.



This is the second of the "rubber tube framed" flying machines built in Washington, D. C. The claw-like flippers at the wing tips are intended to maintain flight by man power after the machine is launched glider fashion from a hill top.

condor, buzzard, seagull and other large heavy birds who must take prolonged runs in which the energy of their wings and legs are combined before the air reaction is great enough to lift them from the ground. The eagle approaches the 50 pound limit beyond which Chanute believed no bird or animal could fly by flapping wing methods by its own unaided effort.

However, these estimates are not the ultimate as we know aerodynamics today. It is possible for man to fly by his own efforts providing the airplane lifting surfaces can be refined to the point where the lift-drag ratio is increased from an average present value of 20.0 to a value of 30.0. This can be easily proved by the following calculations, in which a 160 pound man is taken as the basis of operations. Thus:

Weight of man.....160 Lbs.
Weight of machine... 50 Lbs.

Total weight .....210 Lbs.

Now, if we assume an overall lift-drag ratio of 30.0 for the airplane, which seems possible at the present time, then we have the drag or resistance represented by:

$$\text{Horizontal drag} = \frac{210}{30.0} = 7 \text{ pounds.}$$

Now, let us say, that a speed of 20 miles per hour is under consideration with a total drag of 7 pounds. The horsepower can then be computed as follows:

$$\text{Horsepower} = \frac{7 \times 20}{375} = 0.37 \text{ H.P.}$$

The constant, 375, in the above formula is obtained by cancellation of the feet per mile, foot-pounds per minute and miles per hour.

With the horsepower requirements given as 0.37 H.P., our next step is to investigate the possible power output of a man, and find whether he is actually able to expend this amount of energy. Fortunately, there are many tables worked out on this subject by the various investigators so that we will be able to take actual figures from the tests.

IN THE mechanical engineer's handbook by Moedebeck, we find that a man can develop 1/10 or 0.1 h.p. for several hours at a time, 0.3 h.p. for two minutes and 0.5 h.p. for less than one minute. Thus, according to this data, we could expect a man to fly by his own effort for one to two minutes. Not long, it is true, but then better than has been done up to the present time.

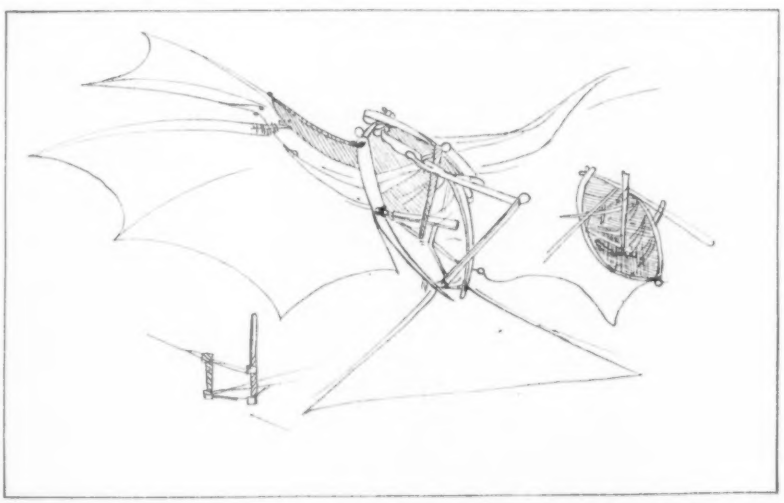
Now Chanute is more generous than Moedebeck in his estimates, for his tests indicate that a man can average 0.13 h.p. for 10 hours, 0.55 h.p. for 2½ minutes or nearly 1.0 horsepower for three or four seconds. In this case, the flight would be greatly extended.

There would be several ways in which prolonged flights could be accomplished. First, to develop a wing section with a lift-drag of from 40.0 to 50.0. Second, to reduce the weight of the machine below the estimated 50 pounds, and third, to find a lighter or more powerful man. At any rate, such flights requiring such a terrific expenditure of energy could hardly be considered in the light of pleasure trips.

There is no doubt but what Chanute is right in his estimates of size and weight effect. The humming bird, which is the most agile of flyers, weighs about one ounce and develops about 0.001 horsepower. A pigeon can develop 12 times as much power as the humming bird, yet it is so much heavier, and its "power-loading" is so much greater in consequence, that it is a much clumsier and less agile flyer.

Now let us go back to history again and investigate some of the early experiment made along this line. First, is Icarus.

The figures and principles so far touched on were not within reach of many of those early aspirants who sought to soar above the topless towers of Ilium, Erin, Albion, Caledonia, Cambria, Gallia and Hispania. One of the first emerging from tradition and dim mythology was Leonardo Da Vinci, mentioned in 99 of every 100 books on flying. We won't dwell on him, even if he was a modern Count Von Luckner in strength, twisting horseshoes easily in his powerful grip.



A 15th century flapping wing flying machine from sketches made by Leonardo da Vinci.

Da Vinci made some drawings which he left for us. That was in 1500.

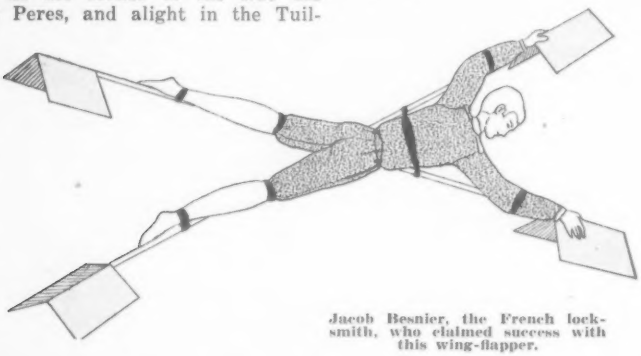
IN 1660 Allard, a French tight-rope dancer, announced that he would fly from the terrace at Saint Germain towards the woods of Vesinet in the presence of Louis XIV of France. He may have made successful glides previously, but on this occasion he fell and was badly hurt.

Eighteen years later Besnier, French locksmith, built a set of oscillating wings worked by arms and legs, right arm and left leg moving together, left arm and right leg. Besnier grew expert in making glides which approached the horizontal, sold his wings to a mountebank who used them at fairs and announced he would begin on a second set. We know nothing further of this second set.

In his first set Besnier used four wings, according to Chanute, each apparently 3 by 2 feet, giving an aggregate of 24 square feet in area. The Mouillard table, which preceded Chanute, revealed that the duck, with the smallest bearing surface in proportion to its weight, has .44 square feet to the pound, or a wing loading of a little over 2 pounds per square foot. At this rate a man weighing 150 pounds would require wings aggregating 66 square feet in area. Besnier's 24 therefore were not enough.

In 1742, the Marquis de Bacqueville announced that he would fly across the river Seine from his mansion, on the quay at the corner of the Rue des Saint Peres, and alight in the Tuileries—500 or 600 feet distant. The Marquis glided probably about 120 feet, when he took his well known plunge onto a washerwoman's barge, breaking his leg. The fall terminated his flying career—and probably lured the startled washerwomen into new varieties of conniption fits.

King Bladub, the legendary flying king of Great Britain, who was killed in an attempt to fly in 852 B. C.



Jacob Besnier, the French locksmith, who claimed success with this wing-flapper.

In 1772 the Abbe Desforges, a canon of the church of Sainte-Croix at Etampes, developed a flying chariot with two wings and a small horizontal sail or airplane attached. Chanute says that from contemporary accounts the aggregate area seems to have been about 145 feet. The wings, according to others, pulled the Abbe down rather than they lifted him up. If he couldn't go up himself he could give flying up (a pun as weak as his efforts probably were). We hear no more of him.

We see more definite developments with the arrival of Meerwein upon the scene. This inspector of public buildings in Baden, Germany, about 1784 made the first sensible study of the size of the wing surface necessary for man. He took the wild duck as his model and decided that a man, weighing 200 pounds with his machine, needed 126 square feet of area to support him. This approximate figure was verified by Otto Lilienthal 100 years later. Meerwein built a machine weighing 56 pounds and with about 111 square feet of area. He made an experiment with it at Giessen but was not successful. Theory was still yielding to practice.

The next important milestone was erected by Charles Spencer in England in 1868. People of his time insisted that he really flew. Spencer was an athlete, small, wiry but very powerful. He did his alleged flying like our heavy birds today—by running, getting a good start and launching himself into the air. By making his preliminary run downhill, Spencer acquired enough speed and momentum to be added to his vigorous wing exertions and this resulted in an approximately horizontal flight of 120 to 130 feet.

SPENCER weighed 140 pounds, his apparatus weighed 24 pounds and consisted of a pair of wings, each measuring 15 square feet, to which was attached an airplane measuring 110 feet more. He also had a tail

(*Continued on page* 122)

An Airplane Engine That Was Thirty Years Ahead of Its Times

One of the most remarkable aeronautical engines in history was built thirty years ago by Charles M. Manly for the famous Langley "aerodrome". It was truly twenty years ahead in design, for its weight per horsepower was less than the average for engines built in 1932.

It was a five-cylinder, water-cooled, radial with a five-inch bore and a five and one-half inch stroke. It weighed only 125 pounds and delivered 52.4 horsepower at 950 r.p.m. Although it was never used in actual flight, it successfully completed a thirty-hour dynamometer test and was in excellent condition at the finish, running at full power during the entire test.

It was very modern in design, the exhaust valves being operated by a cam and push-rod. The crank-shaft was also quite modern in design. Perhaps the only mechanical feature in its design which is now obsolete was the automatic intake valves. They were held closed by a spring until they were opened by the suction of the piston on the down-stroke. This method of intake valve operation was common with old-time engines. The cylinders were of 1/16 in. thick drawn steel, lined with cast iron of the same thickness. The pistons were also of steel.

The miniature model-airplane engines now on the market are by no means anything new, Mr. Manly having also designed and built a small edition of his engine for use in the Langley quarter size model "aerodrome" which made a successful flight in August, 1903, just four months before the first flight of the Wright Brothers. This little engine made the first heavier-than-air flight by an internal combustion engine.

This engine was similar in design to the larger one, except it was air-cooled. It was a five-cylinder radial type with a bore of 2 1/16 in. and a stroke of 2¾ in., developing 3.2 horsepower at 1800 r.p.m. It weighed only 10 pounds complete with ignition, carburetor, and a small storage battery. The flight of the model was cut short by carburetor trouble. Otherwise, it was a very satisfactory little power plant.

This tiny engine is not so well known as its larger brother, but it deserves equal recognition, for it was a remarkable piece of mechanism in its day and is a credit to the genius who designed it.

New Radio Beacons

A CHAIN of directive radio beacons, broadcasting dots and dashes to guide pilots over the true course, are soon to be installed on the 1,206 mile airway between the Mexican and Canadian boundaries on the Pacific Coast.

The Department of Commerce has authorized installation of thirty additional radio beacons on the nation's network, and five of these are on the Pacific Coast route.

Do Pilots Like Their Jobs?

by "T-2003"

OUR old friend, T-2003, presents the results of a survey conducted among pilots, as to whether they like their jobs, and if so, what part of the job they like the best. This survey should be of great interest to students and prospective pilots.

"Two regulars—one Army and one Navy—would appreciate two years' leave without pay to indulge in aerial exploration or scientific research." Here they are all togged up ready for a high altitude flight.

AGAIN good old T-2003 becomes Nosey Mose, the Inquiring Reporter, to get the consensus of opinion of some of our foremost American flyers and others not so prominent.

Over a period of four months, after the usual salutation and commiseration upon meeting up with "one of the boys", I gradually worked my way around until the subject of flying was brought up. (Funny how you have to maneuver around to get some pilots to talk business.) Then, offhand, to catch them off their guard, I'd ask them a question—like this: "Suppose you had your choice, what kind of flying would you like to do; where, how, when and why?"

I questioned the following in my desire to find out what the boys and girls would like to do:

THE PILOTS

20—Mail and transport pilots.

20—Army or Navy officer-pilots (10 each).

10—Pilots engaged in pay-hopping, testing and non-schedule flying.

20—Private and L. C. pilots with no great experience.

THE NON-PILOTS

10—Employees of operating companies who fly considerably, hostesses, engineers, mechanics, etc.

20—People who fly rather frequently as passengers, some of them newspaper aviation editors with considerable knowledge of all types of flying.

That makes 100 people interviewed. No serious consideration was taken of desires beyond the probable capability of the person interviewed, such as the three fledgling pilots who wanted pilots' jobs on exploration parties or globe circumnavigation flights, nor of impossible wishes, such as the five experienced pilots who stated they would like to be going through the throes of their first solo flight once again. At first I considered qualifying my question by adding: "That is, if extra pay were no incentive", but after consideration, I thought it best to hold the answer down to that work which the answerer was probably capable of performing, or would soon be qualified for.

LET'S look at the chart and see what the *employed* transport pilots have to say. I use the word "employed" because a canvass of unemployed pilots would only show their preference for "that job"—any job in fact, that might be readily available. Three transporteers said they liked their work, any phase of it, and considered that night work was worth exactly the extra pay that you get for it, so night or day it was jake with them.

TABLE OF PREFERENCES

	20 Transport Pilots	20 Army-Navy Pilots	10 Pay-Hoppers	20 Private Pilots	10 Flying Employees	20 Flying Passengers	100 Total
Transport	3	2	3				8
Day	3				2	8	13
Night	4	1			4	6	15
Mail		3	3			1	7
Day	1						1
Night	2						2
Army Flying	2	6	2	3		2	15
Navy Flying	1	7		1	1	1	11
Test Work			1	3		1	5
Stunt Work				6			6
Exploration	2	2			1	1	6
Instructing	1		1	3			5
Night Flying				2	1		3
Glider				2			2
Non-Flying	1				1		2

Three others wanted the extra pay for night work, but four preferred evenings at home with the family or friends and didn't cherish the idea of trying to sleep with the sun pouring in through the window and hucksters yodeling their wares on the sidewalks below. Three others said they were sick of hauling passengers and wanted to fly mail on their own and all alone, to push on or jump as they pleased.

Two of the ten transporteers, who were incidentally Army Reservists, said they wished that there were vacancies in the Regular Army Air Corps. They were under 29 years of age and would gladly take the examination, being more than willing to start in at the $205.00 a month which a second looie gets with pay and allowances when hauling Army aircraft for Uncle Sam.

One lad was itching to get a year or so of active duty in Naval Reserve aviation, even though it would affect his seniority on the line for which he was now working. Of the two would-be explorers, one was an "ex-explorer" and he frankly stated he would be tickled pink to look for lost cities in Brazil or for the East or West pole as soon as they get invented.

The other had money. He could afford to quit working for a living as soon as he got a chance to do what he termed "interesting flying". The nineteenth lad wanted to open a school as soon as times got better, and so did the twentieth hauler of mail-and-man-

kind, only this last man would thereafter quit flying.

Said one fine transport pilot, on a western run: "My job, I think, is the best in the world. I was a junior officer in naval aviation when I resigned to get into this work and up to that time I never had any real responsibility placed on my shoulders. When I was first given this run I used to feel the passengers' eyes boring through the cabin bulkhead and into my back whenever the weather got sloppy. Now I just eat up the responsibility of having a dozen passengers dependent on my skill, judgment and experience.

"I can turn back when I want—no one questions it any more. I read my sheiky co-pilot's fan mail. The other day a former fellow officer of mine rode through with me. A lieutenant. We were going up to the office together after the flight when the clerk called me 'Captain' (that's our designation) and very respectfully too. Joe said, 'Hank, I really envy you.' I knew how he felt.

"The mail boys can have their lonesome fog flying, but I want sociability. Transport pilots on the big-time runs are not numbered by the thousands as yet, but I'm one of 'em. What I mean, I like my job."

THE Army and Navy pilots questioned, were both regulars and reserves on active duty. The majority liked their own work and these were not all West Pointers nor Annapolisites either. Two Naval reservists and one Regular Army bird wanted to connect with a transport line, while three other young service flyers wanted to haul mail.

Two regulars—one Navy and one Army—would appreciate two years' leave-without-pay to indulge in aerial exploration or scientific research. Did impending legislation for the reduction of service personnel tend to make some of the flyers look elsewhere for jobs?

As for the ten pilots engaged in nonschedule flying, six wanted mail or transport work. Two wanted some extended active duty in the Army. One thought his present job with a manufacturer was the most fascinating of all jobs, and one other wanted students instead of see-the-city-by-air-passengers.

While we mention test work, the Army and Navy peelots who preferred their own kind of flying would also take assignments to Wright Field as test pilots. This would be an interesting phase of their career, and they also would like assignments as instructors at the Army schools.

NOT all of the amateurs, or comparative novices in piloting, looked forward to a career with the transport lines, although a majority hoped to land such a job when they built up their time by stunting, instructing or just flying around—the latter flying preferably at night.

(*Continued on page* 129)

Uses a Smoke Signal

Here is the German rocket signal.

GERMANY'S sole defense against the invasion of military planes consists of a rocket parachute signal. When a foreign plane has crossed the border, the rocket is a signal for the offending plane to land according to international law.

It must be understood, that by the treaty of Versailles, all means of aerial defense have been denied to Germany so that a direct attack cannot be made against the invading plane.

Electrically Operated Flares

TESTS made with electrically operated flares prove that they are more successful than flares operated with parachutes. The flares are projected 40 feet from the airplane in a horizontal direction before igniting, and then illuminate the surrounding country with the approximate brightness of a full moon.

The flares shown in the photograph were tested at an altitude of 2500 feet, and the signal light was visible for 35 miles.

Installing the electric flares.

Steam Cooled Airplane Engine

FINAL tests, now under way by the English Royal Air Force, are expected to prove conclusively the advantages of cooling aircraft engines by means of condensed steam, as compared with the water-cooling system employed generally, not only by military and commercial establishments elsewhere, but by manufacturers of motor cars almost everywhere. The military value of the new device is said to be great.

Experiments during the last two years, beginning with the application of the evaporation or steam-cooling method to rigid aircraft, especially the R101, now show, according to latest reports, the successful use of the condenser in relation to airplanes. For several months fast day-bombers driven by engines cooled by condensed steam have been flown on trial. Two new high-speed, night-bombing planes and a large multi-engined seaplane were similarly equipped and tested recently.

Instead of the usual large honeycomb radiator necessary to water-cooling, the evaporative or steam-cooling system uses a condenser which is mounted above the engine, preferably within an airplane wing. Steam from a "header" tank, situated between the engine and condenser, rises to the condenser where the steam is cooled until it becomes liquid prior to its return to the engine circuit. Water circulates endlessly within the cylinder jackets and through the header tank.

One of the superior phases of the steam-cooling system is a reduction in the weight of water necessary to the operation say of a 500-horsepower motor; the estimated saving in weight being 100 pounds. But an even greater advantage is ascribed to the new method, that which lowers the vulnerability of a military plane. During the latest war the lives of many pilots were jeopardized when bullets or similar missiles pierced the radiators of their craft. Had steam condensers been used to cool the engines, the degree of peril to pilots would have been much less, due to the great difference in density between steam and water. The rate of escape of steam from the condensers as compared with water from radiators would have been as 1 to 966, according to estimates by proponents of the evaporative system.

Tests made lately revealed, it was said, that a damaged condenser does not impede a safe landing. Holes in the condenser do not appreciably affect the temperature of the engine. Cooling by steam reduces the risk of freezing when the engine is not in use, an advantage of peculiar value to commercial aviation. The new method, according to those who have witnessed its experimental application, also warms an engine before flight more quickly than the water-cooled way. The engine equipped with a steam cooler runs always near boiling point.

The Story of the Famous "Mystery 'S'"

by CHARLES C. BARRENBRUGGE

How the ideas of two progressive engineers worked a revolution in airplane design by presenting the "Mystery S" ship for a race against the Army craft. This airplane is the father of present-day racing planes.

UP to the winter of 1927, building an airplane was rather an experiment for the manufacturer and not a completely pre-designed job to be followed with the utmost precision. An airplane was first built, tested and then re-designed for better performance. It was considered quite impractical to design a ship entirely on paper and expect it to live up to its required specifications.

To give the industry a plane completely calculated on paper was one object of Herbert Rawdon and Walter E. Burnham, two very capable engineers. This was the idea in mind when they began their design of what was later to be known as the "Mystery S" ship. The other objective was to build a plane that would outclass the army at the National Air Races.

Previous to this time the army had been carrying away the laurels to such an extent that the races were becoming less interesting every year.

Secretly they worked on this plane until the summer of 1929, when Travel Air decided they would build the ship to carry out the sporting idea for which it was intended by its designers. Secret construction was immediately started and the first plane was finished in August, 1929.

During its construction, newspapers and magazines all over the country were trying to gain information about the ship that was to be a worthy competitor for the army at the National Air Races. Every attempt to gain such data was futile, thus came about its name, the "Mystery Ship".

Its high speed performance was one of the outstanding events of the races.

A side elevation of the "Mystery S" showing the care with which the streamlining was carried out. Note the engine cowling, the "pants" and the tapered symmetrical fuselage.

In the free-for-all-race of September 2, the Mystery S attained a high speed of 194.9 m.p.h. This was several miles an hour better than its military competitor.

During the race, Doug Davis of Atlanta, Georgia, who was piloting the Mystery S, lost his sense of direction as he turned a pylon. Thinking he had cut it short, and not wanting to be disqualified, he turned around, came back and circled the pylon twice. Even then he crossed the finish line ahead of his military competitor.

It was a surprising fact that on its first test flight, the airplane performed in excess of the predictions of the designers. Its top speed of 230 m.p.h. was 15 per cent faster than was calculated. This was due to the neat design of the N. A. C. A. cowling. It landed at 72 m.p.h.

The original plane was powered with a special Wright R-975, nine cylinder Whirlwind engine developing approximately 400 h.p. at 2,300 r.p.m. The increase in power over the standard 300 h.p. Whirlwind was obtained by augmenting the compression ratio and the speed of the supercharger.

Because of this method of increasing power, a rather surprising fuel consumption economy at cruising speed was observed. According to the manufacturer, the gasoline consumption at 1,550 r.p.m. (150 m.p.h.) was 13 gallons per hour.

The "Mystery S" under construction, during which time all operations were carefully kept secret and withheld from the press.

THE Mystery S is a typical low wing monoplane having a span of 29 ft. 2 in. and an overall length of 21 ft. 2 in. The weight empty is 1,475 lbs. and the disposal load 465 lbs., giving a gross weight of 1,940 lbs. With the 400 h.p. engine, the power loading is but 4.6 lbs. per h.p. The wing loading is 15.6 lbs. per square foot.

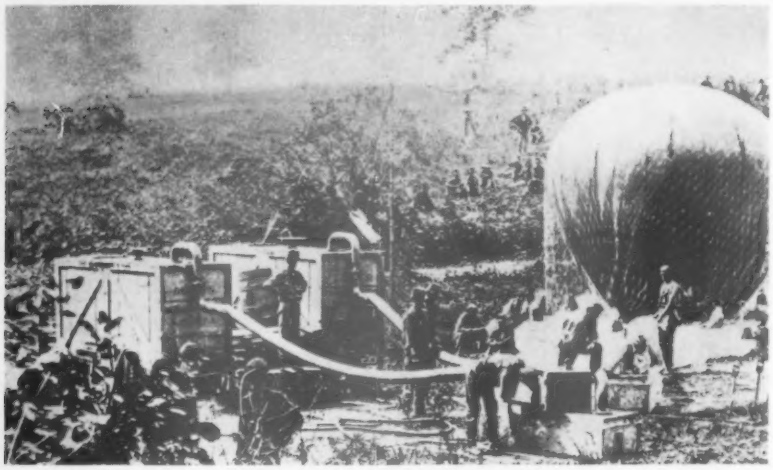
Despite the remarkable performance of this airplane, there is nothing radical in its design. Aerodynamically, it is a conventional low wing monoplane, streamlined to the highest possible degree and embodying practically every known device for the reduction of drag. Tapered wings, wheel fairings, and elliptical fuselage section all contribute to the overall efficiency and even the rudder is so constructed that its lower portion carries the streamlining of the fuselage to a sharp edge at the rear.

External bracing is effected by the use of streamline wires attached to a

(*Continued on page* 125)

The Report of the First U. S. Aerial Observer

by WALTER E. BURTON



Official Photo U. S. Army Air Corps

Filling the balloon from the box-like hydrogen generators. Smoke of a battle will be seen in the background.

SOLDIERS of both armies were cursing the August heat, made more unbearable by a steaming rain; that is, all but a little group of Union men, who, clustered in a Virginia field, were too busy to notice the weather, except to wish that it would quit raining.

They were engaged in inflating a big round balloon with hydrogen gas, produced by clumsy box-like generators, which were connected to the bag by lengths of flexible hose. The rain, of course, was making their work more difficult and unpleasant; but what worried them most was that it was weighting down the balloon and making visibility poor.

Finally, the downpour stopped, and John La Muntain, aeronaut, carrying telescope, note paper and other equipment, climbed into the balloon basket and gave the signal to pay out rope. A short time later he was floating 3,500 feet above the earth, eagerly scribbling notes about enemy encampments, gun positions and ships.

La Muntain made two flights that day, August 10, 1861, and when he returned to the ground, he prepared what is perhaps the first aerial observer's report in the history of the United States Army. That report lay unnoticed for years among dusty war records at Washington, until it was brought to light a short time ago by an army officer who was carrying on some historical research. The report, transcribed from the aeronaut's letter, follows:

August 10, 1861.

Maj. Gen'l
Benj. F. Butler

Sir: I have the honor to report that on the 10th of Aug. I made two ascensions in which I attained an altitude of 3,500 *feet and made observations as follows: About five or six miles west from Hampton I discovered an encampment of the enemy, but owing to the misty state of the atmosphere caused by the recent rain I was unable to form a correct idea of this nominal force, but judge from four to five thousand.*

There were no vessels or encampment of any kind either at York or Back Rivers, or at Newmarks Bridge. On a branch of the James River about 5 miles from Newport News on the opposite side there is a vessel at anchor. On the left bank of the James River about eight or nine miles from Newport News is a large encampment of the enemy, from 150 *to* 200 *tents. Also an encampment in the rear of the Pig-Point batteries of from* 40 *to* 50 *tents.*

At Norfolk two large ships of war are laying at anchor in the stream, one of which appeared all ready for sea, with sails set, etc. No operations at Farmers' Creek. I illustrate what I saw by the accompanying, hasty diagram; the guns, which I discovered in a previous ascension, proved to be only heavy field pieces mounted on carriages —along the coast below Sewell's point no batteries or enemy were visible.

With respect,
(Signed) John La Muntain,
Aeronaut.

The discovery of this letter recalls another balloon episode that made aviation history, and which occurred two months before La Muntain's flight. In June, 1861, T. S. C. Lowe, famous aeronaut of Civil War times, floated over Arlington, while he sent a telegraphic message to President Lincoln in Washington across the river. He told the president that, from his vantage point in the air, he could see the country clearly for 50 miles across.

This first demonstration of the combined use of balloon and telegraph so impressed the president that he received Lowe officially the next day.

Eyelashes Are Traveling by Air

ARTIFICIAL eyelashes — 8,000 of them in one box—silk worms, serum, orchids and perfume. These are a few of the products now traveling by air as a result of a fifty to eighty per cent reduction in air express rates.

During the four years of air express, thousands of shipments of a wide variety have been expedited by air. A check of the air express traffic in recent days shows that it includes important documents, banking paper being hurried across the country to save interest charges.

Radio parts, electrical devices, castings and even 175-pound machine parts, news films, samples, and fancy merchandise are being sent.

New regulations permit shipment of packages weighing up to 200 pounds, with a maximum value of $5,000.

Los Angeles and New York 28 Hours Apart

A LATE breakfast in Los Angeles and breakfast in Chicago, lunch in Cleveland or dinner in New York the next day, is the newest schedule across America, inaugurated by United Air Lines.

West bound passengers can have breakfast in New York, lunch in Cleveland, Detroit or Chicago and lunch on the Pacific Coast the next day.

No Wings—No Propellers

THIS model, having no wings nor propellers, will be driven by compressed air.

A central engine draws in air through the front end of the center cylinder, the air is compressed and then is discharged to the rear in the form of a jet. Ascent and descent is regulated by temperature control in the gas chamber.

Here is the model of the compressed air ship.

Advantages of Diesel Engines

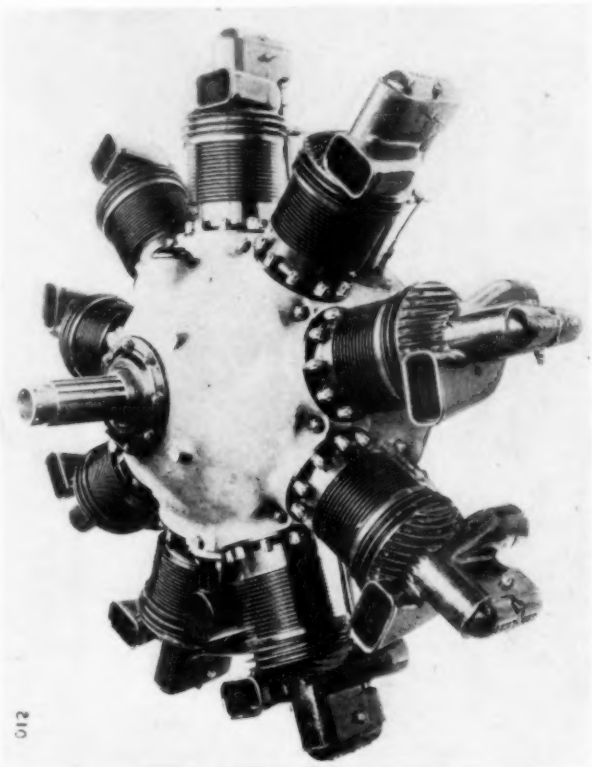
by MAJOR MANFRED A. PAKAS *and* LIEUT. HORACE S. MAZET

Major Pakas, a German expert on aviation Diesel engines, together with Mr. Mazet, discuss the advantages of the fuel oil engine as compared with the standard gasoline aeronautic engine.

WHEN Rudolf Diesel attended the Munich Technical School he paid attention to the pedagogues on the rostrum. He did not allow their teachings to flow in one ear and out the other as soon as class was over. And, following graduation, he became the assistant to the leading technical professor.

Later on, he migrated to Paris where he continued with his engineering work, not forgetting to experiment with certain ideas which thronged his brain. Finally he put on paper his mathematical calculations. They seemed to check. Whereupon he published the results of his labors and his name was made—the diesel engine was a reality.

Heavy, ponderous, but efficient, these engines which were operating on a new principle, spread in popularity until today more than half of all the ocean tonnage in world commerce is shipped in bottoms powered by diesel engines. The inventor had done his work; it remained for his pupils to demonstrate how revolutionary that primitive idea was.



The American Guiberson Diesel engine which has been subjected to strenuous tests in the United States.

Gasoline engines have enjoyed a widespread vogue for a number of reasons. But gasoline engines, or more properly, "constant volume" engines, do not produce power compatible with the energy latent in the fuel. They are notoriously inefficient, developing only about 25 percent of the fuel value, most of the remainder passing off in the form of heat.

Diesel engines, on the other hand, were able to give a good account of the heat energy present, turning out as much as 45 percent of the latent fuel energy. In addition, they operate on cheap fuel or crude oils, greatly reducing their operation costs when compared to expensive gasoline.

In this type of engine, ordinary pure air is compressed to a pressure of perhaps 500 lbs. to the square inch, which generates so much heat that the injected or mixed fuel burns. With burning comes the release of power, which gives the thrust to the piston. A diesel engine does not require electric ignition nor a carburetor, for a volatile fuel is not essential. An ordinary cheap oil of low volatility suffices.

ALL this the German originator, Rudolf Diesel, saw as he worked over his original notes and calculations. He knew that if he could produce sufficient pressure he could use a comparatively inexplosive substance for fuel which would take much less ignition apparatus than the more conventional types of fuel. He found that the burning point of crude oil approximated that of his calculations.

Diesel engines in aircraft have for a long time been regarded as the ideal type of locomotion, but many obstacles prevented diesel-powered aircraft from becoming a reality prior to 1929. They were too large, they weighed too much, their maximum r.p.m.'s were too low, the power output per inch of displacement was too small and in general they left much to be desired.

As far back as the Spanish-American war, a manufacturer in America has been producing stationary diesels, and from 1898 to 1911 the biggest manufacturer in this country was Busch-Sulzer Brothers Engine Company of America. This concern had a national reputation and to date has built almost 800 stationary diesel engines. Now, however, there is hardly an airplane engine manufacturer who has not seriously contemplated the production of diesels for airplanes and airships for their value to such craft is hard to overestimate.

From an engineering standpoint the applicability of the diesel engine to aircraft may revolutionize the present accepted gasoline engine as the universal motive power plant.

Since the engine is the heart of the airplane it is vitally important that any proposed change in the type of propulsion be carefully and deliberately considered before such a radical step is launched. Reliability and dependability are the vital factors in a good motor, to which may be added low operating costs, long term overhaul, absence of vibraton, lightness, compactness and ease of maintenance. These objectives should never be sacrificed; to do so would mean economic suicide for the company manufacturing such products.

In comparing the diesel with gasoline engines, we find that the following advantages are of great importance; decreased fuel cost, decreased fire hazard, non-interference with radio, increased radius of operation, special adaptability to two-cycle motors and special adaptability to large (transport) ships. Cataloguing the disadvantages, we discover that in general they are: increased specific weight of the engine, vibration, increased first cost, difficulty in starting, fuel not generally available, and dissemination of soot or oil.

IT IS obvious that the advantages require little discussion. With the elimination of ignition interference, for the diesel has no electrical ignition system, radio reception is immeasurably bettered, which will mean a great deal in the coming era of radio-con-

trolled and directed aircraft under all sorts of adverse weather conditions. Total elimination of carburetion and distribution difficulties insures added dependability, while the other assets speak for themselves.

Diesel engines for aircraft are no longer chimerical visionary plans, but already have established a few records in the air for low operating costs in this country and abroad. So many experimenters are working on the diesel principle, as applied to aircraft, that it would be idle to review each particular departure in the various engines as they are tried out. We will concentrate our attention, therefore, on several of the more important developments, which will show the trend toward cheaper flying and more reliable engines which have so long been promised and which are now eventuating.

Among these engines, best known to this country, is the Packard diesel. The first successful Packard air diesel weighed 2.3 lbs. per h.p., a radial air-cooled type with 9 cylinders, having a bore of 4 13/16 in. and a stroke of 6 in. The engine developed 225 h.p. at 1,950 r.p.m.

Only air is taken into the cylinder. Compression then raises it to 500 lbs. per sq. in., which results in a temperature of about 1,000 degrees F. As the fuel is injected, it burns, raising the pressure to 1,200 lbs. per sq. in., and creates some structural objections because of high pressure. In this engine, instead of studs to hold down the individual cylinders, circular steel alloy hoops, in front and rear, clamp all cylinders to the crankcase. The hoops contribute greatly toward weight saving and strength.

Because of the greater expansion of gases, a reduction in cooling fin area is possible, cutting down heat dissipation, which effects greater efficiency.

The Packard Company, on May 13, 1929, flew its first diesel motored airplane from Detroit to Old Point Comfort, Va., a distance of over 700 miles, in six hours and forty minutes, at a total cost of $4.68 for fuel oil. Figure the fuel rate per mile yourself.

In the National Air Tour of 1931, this diesel operating on ordinary furnace oil completed the 4,935 miles at an average of 11.3 miles per gallon of fuel. It weighed 520 lbs. and was rated at 225 h.p. Because of the engine's simplicity and few moving parts, it could be disassembled in 17 minutes. Continued tests of this engine reveal interesting data.

WITH it, there is a gradual increase of revolutions per minute and power output from sea level to approximately 8,000 feet. In tests conducted in 1931, the plane had a speed of 116.5 miles an hour at sea level with an engine speed at 1,980 r.p.m.; a speed of 118.6 miles an hour at 8,000 feet with an engine speed of 2,015 r.p.m. and a speed of 110.6 miles an hour at 15,000 feet with 1,950 r.p.m. The ab-

(*Continued on page* 132)

Mounting Lightplane Engines

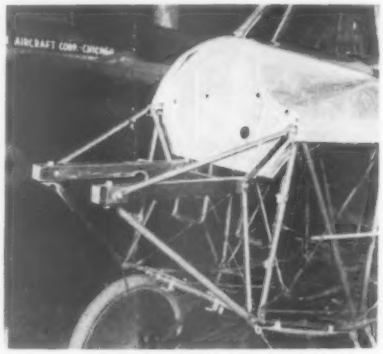


Fig. 1. Showing engine bearers and supports.

WE have had so many inquiries from our readers asking how an engine of the four-cylinder type can be mounted in a lightplane, that we are showing an approved method by the two accompanying photographs. The engine shown is a four-cylinder "in-line" air-cooled type, but the same method can also be applied to a water-cooled engine such as a Ford or Chevvy engine.

In Fig. 1, we see the two wood engine bearers running out horizontally from the bulk-head. These bearers are the foundation to which the engine lugs or base flanges are bolted, and must be spaced apart and of the right length to accommodate the particular make and type of engine to be installed.

These wood engine bearers are supported and braced by lengths of small seamless steel tubing, the inner ends of which are bolted to the fittings located at the ends of the fuselage longitudinals. These tubing members are so arranged that they brace the bearers in every direction, sidewise as well as vertically.

Two tubing braces run from the outer end of each bearer to the longitudinals. At the inner ends of the bearers, we see two shorter and more direct braces connected to the same point on the fuselage structure. The first named braces hold and steady the outer bearer ends, while the latter braces are largely weight carriers.

In Fig. 2, the engine is mounted in place with the base flanges bolted to the bearers. The spinner cap and propeller are at the left of the assembly. After the engine is mounted, and connections made to it by tubing and wires, the sheet metal cowling is put into place around the engine. Smaller supports, not shown, will be necessary for the support of the cowl.

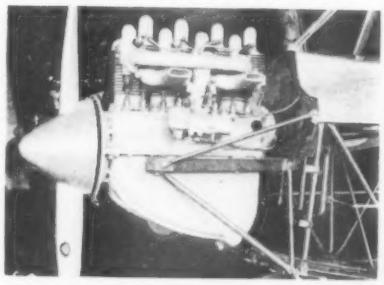


Fig. 2. Engine mounted on bearers.

Planes Flew 20,000,000 Miles at Night Last Year

NIGHT flying by air transport companies in the United States, operating mail-passenger planes over established airways on regular schedules exceeded 20,000,000 miles in 1931. Night operations take on added significance each year because of the public demand for night as well as day flying schedules.

United Air Lines, which flies more miles at night than all European nations combined, flew 6,000,000 miles of the total of 20,000,000 night miles.

By flying at night, tri-motored passenger transports move mail, express and passengers between the Pacific Coast and New York in twenty-eight hours. An interesting statement of its night operations is contained in the following bulletin of United Air Lines:

The planes have special night flying equipment; electric lights, retractable landing lights in the wings and four 400,000 candle power flares, each of which can illuminate one square mile for three minutes. Airports are flood lighted.

As the pilot takes off, amid the lights that flood the field for a division point 300 miles away, a code message goes out over the teletype circuit reading:

"United Air Lines plane license No...., Pilot Lewis, departed.... twelve midnight for....."

This message is automatically reproduced on receiving machines at strategic points on the airways to check the plane's progress.

As the pilot gains altitude he is greeted by a flash of clear light. As it revolves, a red light, a course-light, flashes a dot-dash code signal. As the red code signals discontinue the revolving beacon's white flash again appears. This continues from sundown to sunup on the chain of beacons spaced about ten miles apart.

Every third beacon light has a green course-light for a Department of Commerce intermediate landing field, marked by boundary lights 250 feet apart. These fields are maintained so planes can make landings between terminals, if advisable or necessary.

But the pilot may rely on more aids in night air navigation, including the directive radio beacon. Through ear phones he listens to the signals from radio beacon beams to keep him on his course at all times.

A Memorial to the Old "DH"

Old "DH," alias the "flaming coffin," is now a thing of the past. The junking of the last of the tribe by the Army Air Corps, calls back memories of this versatile old ship that performed many notable feats in the past.

EXIT the old DeHaviland from the roster of Army airplanes. Although not used for service during the past few years, a few DeHaviland observation airplanes were carried on Air Corps inventory reports until just recently, when it was noted that the item "DeH 4 airplanes" was conspicuous by its absence. These few relics of days gone by were used now and then for training purposes at Randolph Field, Texas.

"It was a good old crate," say the Army flyers in epitaphing the old standby of military aviation, then they hark back to the "Jenny"—given its K. O. on September 1, 1927—and the last Martin Bomber, which gave up its bimotored ghost about two years ago.

It was in the role of a bomber and observation plane that the DeH, with its Liberty engine, saw service on the American front, taking its place alongside the Breguet and Salmsons. When the War ended, America had 45 squadrons on the front, and, of these, 5 observation squadrons and 5 bombardment squadrons had DeH planes.

There were 1,379 DeH's received in Europe from America up to November 11, 1918, and 740 of these had been sent into the Zone of Advance. The early model was the DH4A, with the pilot stuck up under the center section, followed by the gas tank, and then the observer. When a crash was imminent, the wise observer would loosen his safety belt so that he would shoot out over the center section and not see the pilot, trapped in the burning wreckage with the gas flowing over him, gradually roasting to a turn.

Then the DH4B came into general use, this ship having the gas tank back of the engine. The pilot and the observer could now pass messages to one another during a mission. Later models in 1924 were metal fuselaged and known as DH4Ms, and the special purpose ships were the DH4M2P (for photo work) and the DH4M2S, a metal fuselage DH with supercharged Liberty motor. This latter model was used for towing targets for aerial gunnery and anti-aircraft practice at high altitudes. DeH planes also did much of the pioneering in the airmail.

Official Photo, U. S. Army Air Corps.

The old "DH" in flight, in one of its various modified forms. Not a bad looking ship at that —even though it descended from 1917.

Back in 1920, Captain St. Clair Street, now Chief Test Pilot of the Flying Branch, of the Materiel Division, Wright Field, Ohio, headed an expedition of four DeH's from New York to Nome, Alaska, and return.

In September, 1922, "Jimmy" Doolittle, one of America's outstanding pilots, made a one-stop flight from Jacksonville, Fla., to San Diego, Calif. He negotiated this transcontinental air journey in 21 hours and 18 minutes. In the year following, Doolittle accomplished an outstanding cross-country flight in a DeH, equipped with an extra size gasoline tank. Flying from Dayton, Ohio, to the Pacific Coast and return, he covered a total distance of 6,765 miles, between August 6 and August 14th.

The year 1923 was replete with remarkable flying achievements by Air Corps pilots, utilizing the DeH plane, the most outstanding of which was the Porto Rican flight. An expedition of six DeH's, carrying 12 pilots, and headed by former Major Thomas G. Lanphier, successfully completed the journey by air from San Antonio, Texas, to San Juan, Porto Rico, and return, covering a distance of approximately 6,000 miles. This flight between April 3 and May 3, 1923, was made in easy stages with no attempt to break any records.

On May 26, 1923, Lieutenant H. G. "Scotty" Crocker flew non-stop from the Gulf of Mexico to Detroit, Mich., in 11 hours and 55 minutes.

With the aid of a friendly wind, the DeH, piloted by Lieutenant Albert F. Hegenberger, later of Hawaiian Flight fame, streaked it between Dayton, Ohio, and Langley Field, Virginia, February 14, 1923, at an average speed of 202 miles an hour.

Former Lieutenant Harold R. Harris, in a DeH, equipped with a supercharger, reached an indicated altitude of 29,400 feet on December 13, 1923, and encountered a temperature of 29 degrees below zero.

Lieutenant W. R. Peck, flying a DeH, equipped with an extra size gasoline tank, flew non-stop between Kelly Field, Texas, and Kokomo, Indiana, a

(*Continued on page* 129)

And here we have the "DH" playing mail-man on the first scheduled airmail service in the United States. A sturdy old crate.

Question and Answer Department

All questions of general interest on any phase of aviation will be answered authoritatively by POPULAR AVIATION'S Technical Staff.

WE HAVE had a great many questions submitted to us this month, part of which are answered in this department and the remainder will be found in the Pilot's Exam Questions on another page of this issue. They are not included here for obvious reasons.

We wish to remind you that this department is open to all of our readers and we heartily solicit your inquiries so long as they are within the scope of this department. Address your inquiries to Question and Answer Department, POPULAR AVIATION, 608 S. Dearborn St., Chicago, Ill.

* * *

QUESTION:—F. R. Teetor, Boston, Mass. *How does lubricating oil reduce the friction and wear on an airplane engine? Does the crankshaft slide over the wetted surfaces or what does take place on an oiled surface?*

ANSWER:—IT was formerly believed that the shaft and bearings were completely covered with a sheet or film of oil at all times, so that the shaft virtually floated on this film. However, recent research has indicated that this is not the case, and that it is seldom that a perfect film exists at full speed or with a fully loaded shaft.

According to the latest theory, a lubricating oil penetrates into the outer skin of the bearing and shaft metal, forming a sort of velvety soft amalgam that offers very little resistance to motion. The idea can be grasped better if we imagine that the shaft is covered with a strip of velvet, the fine hairs creating little resistance.

* * *

QUESTION:—David Hartley, Milwaukee, Wis. *What are the advantages of a four valve engine over an ordinary engine with one inlet valve and one exhaust valve per cylinder?*

ANSWER:—BY the use of four valves, two inlet valves and two exhaust valves, it is possible to get as much free area for the flow of the gas as with one very large valve. The valves are smaller and lighter, they do not pound on the valve seats so heavily, the springs can be made lighter and with less danger of breakage and there is less vibration. More of the cylinder head area is available in the four valve type, and great gas port area can be had with a given size cylinder when the four valves are employed.

* * *

QUESTION:—George Parakus, Denver, Colo. *How does a super-charger operate? How does it increase the engine power, particularly at high altitudes? Does it increase the consumption of gasoline for the increased power?*

ANSWER:—A SUPER-CHARGER is simply an auxiliary charge compressor, usually a high-speed blower type that draws the mixture from the carbureter and then forces it into the intake of the engine. This is effective in three ways. First, it increases the amount of fuel taken into the cylinder over the amount that would normally be sucked into the cylinders by the piston suction. Second, the greater volume of air taken into the cylinder increases the compression and again increases the power. Thirdly, the supercharger more completely vaporizes and mixes the gasoline spray with the air, again adding to the effective power produced by the engine.

At high altitudes where the density of the air is reduced, the super-charger maintains a higher mixture pressure at the inlet, making it possible to operate with a better output than in the case where the rarified air was sucked in by the movement of the engine pistons.

Under many conditions a super-charged engine is more efficient than without the super-charger, burning less gasoline than when running normally. Under certain other conditions, the efficiency is impaired by the super-charger, always remembering that a considerable amount of power is taken for driving the super-charger.

* * *

QUESTION:—Harry McLane, Davenport, Ia. *What is meant by the word "safety factor" when applied to the strength of airplane parts?*

ANSWER:—THE safety factor of a structural member is a number by which the actual load on the member is multiplied to get the actual safe stress on the material. This is often referred to as the "coefficient of ignorance" for the reason that it takes care of unknown defects in the material and workmanships.

Thus, if an airplane part is loaded to 1,000 pounds, it would hardly be safe to use just enough metal to exactly carry this load, especially if the strength of the metal were assumed

(*Continued on page* 133)

Showing the "N" strut bracing of a Boeing fighting plane.

Co-ed Students

Miss Virginia Berry in a college ship.

CO-EDS are taking an active part in the Aeronautical Engineering courses at the Oklahoma Agricultural and Mechanical School at Stillwater, Oklahoma.

Miss Virginia Berry, pretty co-ed, a resident of Stillwater, is seen at the controls of one of the airplanes used in the school's aviation course.

The Oklahoma Agricultural and Mechanical School is one of the universities that are doing pioneer work in adding aviation to their curriculum.

One of the First Women Airport Managers

MARGARET PERRY is one of the first women in the United States to manage an airport. She has taken over the management of the Culver City airport of California and has qualified for her work.

Miss Perry is a very successful flyer and has been flying for more than two years. She took up flying for the sheer joy of it, but suddenly decided to go into business and, of course, it just had to be a business connected with flying.

She says: "I wanted to see if a girl couldn't make just as good a success in this business as a man and I know they can. I have two training ships on my field for student work and I am planning to run a regular school when I get it all established. My courses will fit the student for a private license, limited commercial, or carry them through to a transport if they wish.

"I love my work and it is a great field for a woman, I think.

"Women are flying more all the time. There are many jobs offered now in flying for women and the chances will increase all of the time when everyone realizes the vast uses of the airplane in a commercial way."

Southern Mail Routes

REGULAR air transport services in Latin America are maintained over routes extending 34,382 miles. There is a total of seventeen operating companies.

American World War Aces

SO many requests have been made, from time to time, for a complete list of the American aces recognized officially at the end of the war, that we are giving you the following list of the names and the number of victories allowed each man.

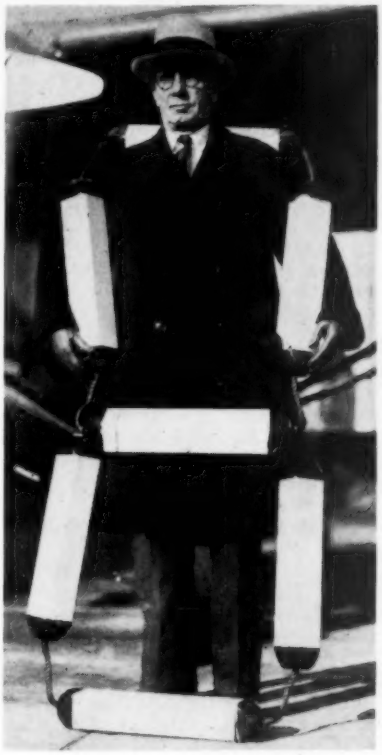
The names and number of victories is official up to November, 1918, and since that time, a few minor alterations have been made. The requests, however, were for the status of the pilots at the end of the war and this accounts for the use of the 1918 list.

According to definition, an "ace" is a pilot who has been awarded five or more victories, hence the pilots showing less than this number have not been listed here.

* * *

Capt. Edward V. Rickenbacker, Columbus, Ohio 26
First Lieutenant Frank Luke, Jr. (killed in action), Phoenix, Ariz.. 18
Major Victor Raoul Lufbery (killed in action), Wallingford, Conn.... 17
Capt. Reed G. Landis, Chicago, Ill.. 12
First Lieutenant David E. Putnam (killed in action), Brookline, Mass. 12
First Lieutenant Fields Kinley, Gravette, Ark. 10
First Lieutenant G. A. Vaughn, Jr., 441 Washington Ave., Brooklyn.. 10
First Lieutenant J. M. Swaab, Philadelphia 10
First Lieutenant T. G. Cassady..... 9
First Lieutenant C. E. Wright, Cambridge, Mass. 9
First Lieutenant W. P. Erwin, Chicago 9
Captain E. W. Springs, Lancaster, Pa. 9
First Lieutenant H. R. Clay, Jr., Fort Worth, Texas..... 8
Major J. A. Meissner, 45 Lenox Road, Brooklyn, N. Y..... 8
Captain Hamilton Coolidge (deceased), Boston, Mass..... 8
Captain G. De F. Larner, Washington, D. C..... 8
First Lieutenant P. F. Baer, Fort Wayne, Ind. 8
First Lieutenant F. O. D. Hunter, Savannah, Ga. 8
First Lieutenant W. W. White, 541 Lexington Ave., New York City.. 8
Second Lieutenant Clinton Jones, San Francisco, Cal. 8
Captain R. M. Chambers, Memphis, Tenn. 7
First Lieutenant Harvey Cook, Toledo, Ohio 7
First Lieutenant L. C. Holden, 103 Park Ave., New York..... 7
First Lieutenant K. H. Schoen (deceased), Indianapolis, Ind..... 7
First Lieutenant W. A. Robertson, Fort Smith, Ark..... 7
First Lieutenant L. J. Rummell, 798 South 11th St., Newark, N. J..... 7
First Lieutenant L. A. Hamilton (deceased), Burlington, Vt., or Pittsfield, Mass. 7
First Lieutenant J. O. Creech, Washington, D. C..... 6
Second Lieutenant Howard Burdick, 175 Remsen St., Brooklyn, N. Y.. 6
First Lieutenant C. L. Bissell, Kane, Pa. 6
Major H. E. Hartney, Saskatoon, Canada 6
Captain Douglas Campbell, Mount Hamilton, Cal. 6
Captain J. C. Vasconcelles, Denver, Colo. 6
Captain E. G. Tobin, San Antonio, Texas 6
First Lieutenant E. P. Curtis, Rochester, N. Y..... 6
First Lieutenant Sumner Sewell (no address) 6
First Lieutenant R. A. O'Neill, Nogales, Ariz. 6
First Lieutenant Donald Hudson, Kansas City, Mo..... 6
First Lieutenant M. K. Guthrie, Mobile, Ala. 6
First Lieutenant W. H. Stovall, Stovall, Miss. 6
First Lieutenant J. D. Beane (missing in action)..... 6
First Lieutenant A. R. Brooks, Framingham, Mass. 6
First Lieutenant R. O. Lindsay, Madison, N. C..... 6
First Lieutenant Martinus Stenseth, Twin City, Minn..... 6
Second Lieutenant F. K. Hays, Chicago, Ill. 6
First Lieutenant H. C. Klotts (no address) 5
Lieutenant Colonel William Thaw, Pittsburgh, Pa. 5
Major D. McK. Peterson, Honesdale, Pa. 5
Captain H. R. Buckley, Agawam, Mass. 5
Major C. J. Biddle, Philadelphia, Pa. 5
First Lieutenant James Knowles, Cambridge, Mass. 5
First Lieutenant J. A. Healey, Jersey City, N. J..... 5
First Lieutenant Innis Potter (no address) 5
First Lieutenant F. M. Symonds, 20 West 8th St., New York City..... 5
First Lieutenant J. F. Wehner (deceased), 124 East 28th St., New York 5
First Lieutenant J. J. Seerley, Chicago, Ill. 5
First Lieutenant E. M. Haight, Astoria, N. Y..... 5
First Lieutenant H. H. George, Niagara Falls, N. Y..... 5
First Lieutenant G. W. Furlow, Rochester, Minn. 5
First Lieutenant A. E. Easterbrook, Fort Flagler, Wash..... 5
First Lieutenant B. V. Baucom, Milford, Texas 5
Second Lieutenant Harold McArthur (no address) 5
Second Lieutenant J. S. Owens, Baltimore, Md. 5

Something New in Life Preservers



Mr. Reno with his life preservers.

J. W. RENO, 70 years of age, of New York City, is the inventor of this new life preserver for seaplanes.

It is made of balsa wood and a few feet of rope. Although it is extremely light in weight, it will support five average size adults.

When it was demonstrated to the New York Police Department and the Department of Commerce, recently, it received very favorable comment.

New Type Bat Plane

THIS peculiar looking plane, according to its inventor, will be able to attain a speed of from 300 to 400 m.p.h. The full sized aircraft will have two engines built into the wings—one on each side.

This is an odd looking plane, the "Bat". Looks some like a fish called the "flounder".

Sample of Transport Pilot's Exams.

Authoritative answers to the sample Transport Pilot's examination questions issued by the Department of Commerce, Aeronautics Branch.

PART I

EDITOR'S NOTE. These answers were carefully compiled and approved by the technical staff of POPULAR AVIATION.

Q. Name the four basic types of clouds.

A. (1) *Cirrus,* (2) *Cumulus,* (3) *Stratus,* (4) *Nimbus.*

Q. What is relative humidity?

A. *It is the ratio of the amount of moisture in the air to the amount of moisture actually required for saturation at the same temperature.*

Q. What is a line squall?

A. *An area of extremely low pressure accompanied by strong shifting winds and driving rain. Can be recognized by long line of low black clouds extending for 10-40 miles.*

Q. Why is there less bumpy air while flying over water than over land?

A. *Over water, there are no obstructions that tend to divert the wind into vertical currents, nor are there unevenly heated surfaces to cause vertical convection currents.*

Q. How are the data obtained that are shown on a weather map?

A. *From the weather observatories maintained by the U. S. Weather Bureau which record the high and low pressure areas, and other data, existing within their territory.*

Q. What is the usual path across the United States of storm areas?

A. *In a southeastern direction through the western and central states and then northeast up the St. Lawrence River valley.*

Q. Are high winds more prevalent in high or low pressure areas?

A. *In the low pressure areas.*

Q. What are convection currents?

A. *Vertical currents of air set up by differences in temperature. The air rises along the heated area and descends along a cooler path.*

Q. What does a sudden drop in barometric pressure indicate?

A. *The coming of a storm.*

Q. Give five kinds of data found on a weather map.

A. *Temperature, Pressure, Precipitation, Wind Direction and Wind Velocity.*

Q. What is an anemometer?

A. *It is an instrument for measuring the velocity of wind or air currents. It is composed of four hemi-spherical metal cups attached to an axis by arms which revolve in direct proportion to the air velocity.*

Q. What causes bumpy air?

A. *Vertical rising and falling currents of air.*

Q. Define, (1) Isobar, (2) Isotherm.

And here we are with one of the tallest pilots to whom a license has been granted—Charles C. "Slim" Dasley, 25, and a mere 6 feet 6 inches tall. Notice the badge and gun—that's what he gets for being the tallest deputy sheriff of New York.

A. (1) *Lines on a weather map connecting points of equal pressure.*

(2) *Lines on a weather map connecting points of equal temperature.*

Q. What is the approximate decrease in temperature with altitude?

A. *3 deg. F. per 1000 feet.*

Q. What meteorological element most affects the motion of the atmosphere?

A. *Heat.*

Q. What is the normal barometric pressure at sea level?

A. *760 millimeters of mercury, or 29.92 inches of mercury.*

Q. What is the general direction of the wind in regard to low pressure areas?

A. *Counter clockwise and toward the center.*

Q. What does the shaded portion of a weather map indicate?

A. *Precipitation of .01 inch or more during past 24 hours.*

Q. If you were flying due east, and a low pressure area was on your direct course, would you fly to the north or the south of it? Why?

A. *South. It would be less severe and you would have a tail wind.*

Q. How is wind direction indicated on a weather map?

A. *By small arrows.*

Q. What is the direction of the prevailing wind in the United States?

A. *From west to east.*

Q. What causes the following: (1) Dew, (2) Fog?

A. (1) *Dew is caused by cooling moist air below its saturation point.* (2) *Fog is caused by warm moist air striking cold earth.*

Q. Does the wind increase in velocity with altitude?

A. *Yes.*

Q. What causes winds?

A. *Difference in pressure at various points.*

Q. What meteorological information would you obtain before flying from Detroit to New York?

A. *Wind velocity and direction at various altitudes ceiling along route; recent movements of high and low pressure areas and precipitation.*

Q. What is the direction of the wind in a low pressure area with reference to its center? (2) Of a high pressure area?

A. (1) *Toward the center.* (2) *Away from the center.*

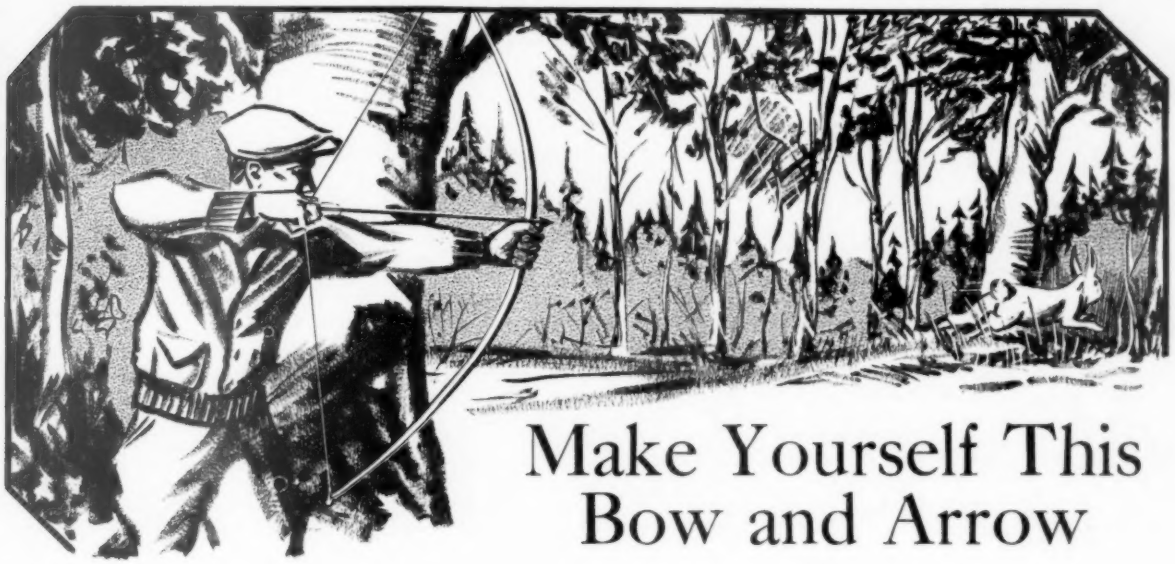
Q. How would you expect the readings of your altimeter to be affected by a rising barometer?

A. *The rising barometer would indicate a higher air pressure which would in turn make the altimeter read lower than the actual altitude.*

Q. There is a large temperature difference between two points. Which way would this tend to cause the surface winds to blow?

A. *From the area of low temperature to that of high temperature.*

PRACTICAL MECHANICS SECTION



Make Yourself This Bow and Arrow

BEFORE the days of gunpowder, the Indians did most of their fighting with bow and arrow. Able masters of archery construction, these redskins killed and scalped many an enemy with comparative ease.

During times of peace, the Indians found their ancient weapons a trusty aid in killing game, particularly fish and small animals.

A good shot with a bow and arrow can still have great sport hunting small animals. Rabbits, racoons, 'possums, and the like are frequently hunted. The fun is exciting, and the danger to others is small.

The archery equipment described in this article is not a toy. It is a real, he-man's outfit. Carefully made, it will shoot with the best on the market.

For many who are not interested in hunting, this bow and arrow set is ideal for target practice. Archery tournaments can be organized in the neighborhood and a prize offered to the winner. If several bow and arrow sets are made, the energetic builder can set up a public range, offering 10 or 15 "shots" for a dime.

For use in either a public or private archery range, a wide variety of targets is available. The most common one, of course, is simply a concentric series of different colored circles. This design can be painted on an ordinary sheet against a backstop of common straw to hold the arrows in place.

Beginners' bows are best made of lemonwood imported from Cuba and other tropical lands. Seasoned archers make their bows of yew, osage-orange or Florida snakewood backed with elm. Osage-orange and snakewood because of their strength and durability are excellent woods for the construction of hunting bows for shooting big game. Other woods used in bow making include: lancewood, hickory, cedar, black locust, and mulberry.

The best arrows are made of Norway pine footed with some hard wood such as beefwood or rosewood. Birch is satisfactory for beginners' arrows. The arrows of experienced American bowyers also are made from red spruce, Port Oxford cedar, Sitka spruce, and Douglas fir.

Homemade bows for men are made 6 feet long with a pull of from 30 to 45 pounds for target shooting. Hunting bows are 5½ feet in length with a pull of from 50 to 90 pounds. Ladies as well as schoolgirls and boys use 5½-foot bows with a pull of from 20 to 30 pounds. It is advisable to begin with a bow of less pull than the maximum that you can handle in order to attain accuracy and the best shooting form and finish. You can then "step up" the strength of the bow you use as your archery proficiency increases.

Staves for bowmaking can be obtained from lumber dealers and wood importers. They should be of straight grain, free from defects and discoloration. They should be about 6 feet long and 1½ inches square. The bark side of the stave should be the back of the proposed bow. If no evidences of bark are visible, the soundest side of the stave, free from imperfections and, if possible, flat-grained should be used as the back of the bow.

THE amateur bowyer first measures and marks the middle point on the stave and then pencils two marks around the future bow, one an inch above and the other 3 inches below this center. The space between these two marks is the handle of the bow.

A line is next drawn with a straight edge lengthwise of the stave while two other marks are laid off at the ends of the stave five-sixteenths of an inch from this middle line.

The sides of the bow are then marked off, these lines curving very gradually so that the bow maintains its average diameter up to points 10 inches, respectively, from either end, whence it tapers rapidly. A very fine rip saw and plane are required for cutting down and shaping up the back of the bow. The desired lateral shape is obtained by tapering measurably near the handles and at the ends.

A block plane or spoke shave is useful in rounding the belly of the bow into a pronounced Roman arch. The amateur bowyer must exercise extreme care to keep both sides of the bow uniform and to avoid lobsidedness. The depth and width of the bow should be uniform at the handle; but at all other points, the depth is less than the width.

After the bow stave is smoothed sufficiently with a block plane, it is ready to be strung. The bowyer notches the sides of the stave one-half an inch from each end for the reception of the bowstring. The back of the bow should never be notched or it will break when subjected to severe service strains.

American archers prefer well-waxed Irish linen because of its strength and durability. From 30 to 50 strands of linen are waxed and then woven and twisted together to form the best bowstring. A woven loop at each end fits into the notches on the bow. Such a bowstring will be serviceable for from 3 to 6 months, depending on how much

it is used; those infrequently used are good for 1 to 2 years.

A 6-foot lemonwood bow when first strung usually has a pull of 60 to 70 pounds. In reducing this pull, the bowyer uses a block of wood 32 by 4 by 2 inches in dimension with a row of 12 notches cut along its side at 2-inch intervals which is called a tiller. The tiller is clamped securely in a vice. The bow is then hung over the end of the work bench and the bowstring is drawn back far enough so that it can be caught in the first notch of the tiller.

The bowmaker inspects the partly bent bow carefully to determine that both "limbs"—the two sections of the bow above and below the handle—are bending practically alike. He marks all points of stiffness so that subsequently, he can work them down with a spoke shave or cabinet scraper until the bow bends evenly.

Then the bowstring is pulled to the second notch of the tiller and the process is repeated. This is continued until the full draw distance of 27 inches is attained. A spring balance is then used to determine the pull of the bow in pounds at the full draw.

The bow is in shape for preliminary shooting when the pull is reduced to about 42 pounds for the average lemonwood bow, to be used by the male beginner in target shooting practice. It is advisable to break in the bow by shooting regularly with it for several weeks before the pull is reduced eventually to the minimum of 30 to 35 pounds.

ULTIMATELY, the bow is smoothed and polished with steel wool or sandpaper, after which a protective coating of varnish or shellac should be applied.

The handle is finished with a tight wrapping of heavy fishline or a suitable piece of leather may be glued into permanent position as a handle. A special leather arrow plate is also glued on the side of the bow. The arrow passes over this protector during the draw and release.

Ordinary birch dowels for arrow making as purchased from lumber dealers usually are crooked and have to be straightened by heat processing methods. Some archery companies now sell straightened dowels for arrow-making and the beginner bowyer will save time and trouble by buying such material. The bowyer cuts the dowels to an average length of 28 inches, the length of the ordinary target arrow.

Bullet casings procured from cartridge manufacturers make the best points for target arrows while hunting arrows are tipped with metal "broadheads" for inflicting mortal wounds. Ferrule cement is used in fastening both types of arrow points in permanent position.

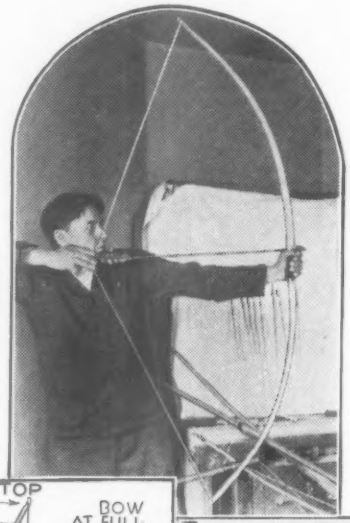
A simple little frame can be made in which to mount 3 hacksaw blades for cutting the notches in the feathered ends of the arrows, these notches being but slightly larger than the bowstring which fits therein. A simple polishing device for finishing the surface of the arrows can be made by cutting a semi-circular groove slightly larger than the diameter of the arrow, placing a piece of sandpaper in this groove with the rough side in, and then rubbing the block up and down the arrow shaft.

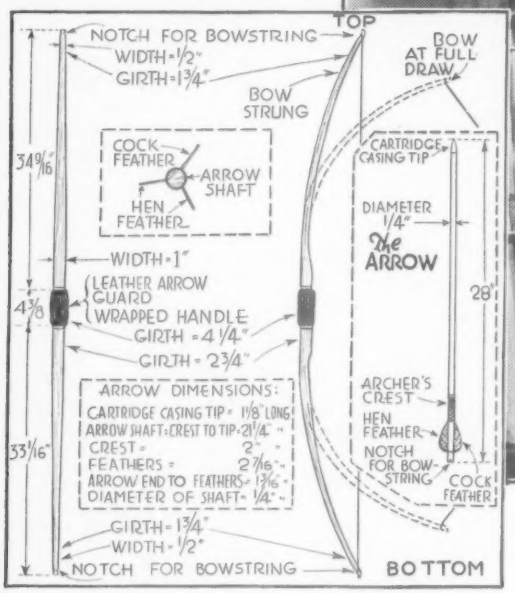
"Fletching" the arrow with turkey feathers is the most difficult task associated with arrow making. These feathers govern the flight of the arrow like the rifling in the gun barrel guides the course of the bullet. Pinion feathers picked from the wings of the turkey hen or gobbler are best for arrow fletching. The feathers are stripped in preparing them for arrow use. That is, the stiff side and some of the midribs are removed without disturbing the vein which is finally cut into 2 and 2½-inch lengths. These small pieces of feather are than sized or cemented to the arrow with either casein or animal glue or household cement.

The cock feather is always mounted on the arrow at right angles to the notch cut for the reception of the bowstring. The two hen feathers are glued into position so that the 3 feathers are respectively 120 degrees apart. Steel pins are employed to hold the feathers in place while the adhesives are drying. After the glue has dried, the feathers are trimmed with either scissors or a sharp knife to a wedge or parabolic shape.

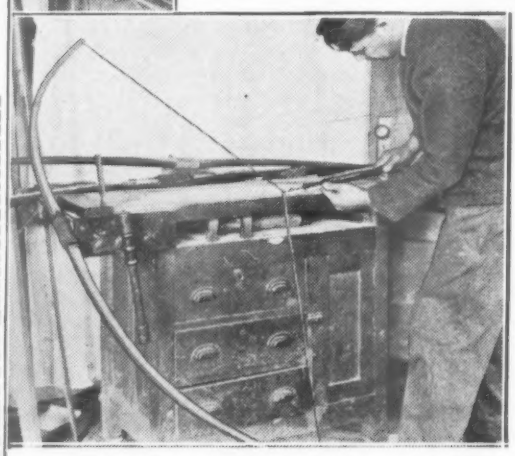
The final step in arrow making is to varnish or shellac the arrows and to mark them with the archer's crest. This crest is a mark of identification, each archer having a distinctive combination of bright colors painted on his arrows near the feather end so that he will always recognize them.

Testing the bow and arrow, showing the correct method of holding it.





Working drawings of the bow and arrow.



Determining the tension of the bow after stringing it. This is important.

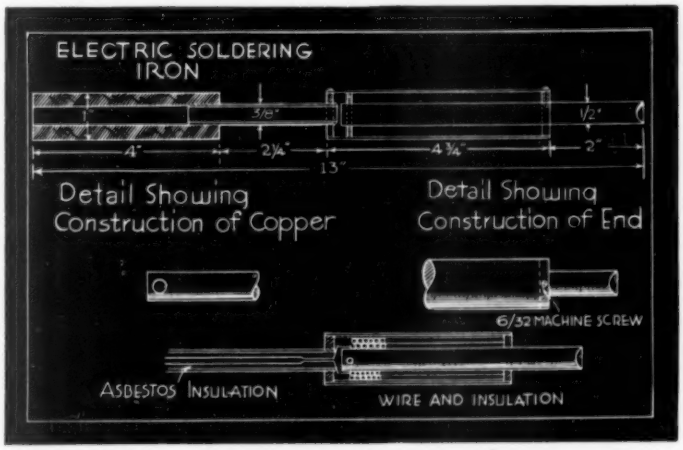
Plans for Making an Electric Soldering Iron

by "HANDY MAN"

This is a simple and money-saving method of making one of your most useful tools—an electric soldering iron. The materials are cheap and the job is easy.

THERE have been numerous designs for electric soldering irons each differing only in some of the construction details. The following design is the result of five years' cumulative experience with the construction of these irons in a school shop. The advantages claimed for this iron are simplicity of construction and availability of parts.

The home mechanic will derive much pleasure from the use of his "iron" and in addition will know how to repair it in case of trouble. Numerous soldering irons are necessary when a large variety of soldering jobs are to be done. The ease with which an electric iron may be used is a sufficient reason for having one in the home work shop.



Constructional details and dimensions of the parts required for making an electric soldering iron. Careful attention must be paid to the insulation.

Materials Required

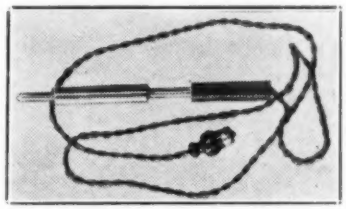
1—Handle
1—Wrought iron nipple, ¼-inch
1—Brass tube, 1-in. O.D., 15/16-in. I.D., 4¾ inch long
1—Nichrome resistance wire, No. 30, 28 feet
1—Copper rod, ½-in. dia. 6 inches long
1—Attachment plug
1—Heater cord, 6 feet long
2—Asbestos sleeving, 5 inches
2—Bushings, iron
2—Machine screws, 6/32
1—Stove bolt 3/16 in. x 15/16 in.
Mica as required

The materials may be secured in the sizes and types as specified, or some changes may be made to suit conditions. The handle may be a file handle, turned on a lathe or a fibre tube. The bushings are turned in a lathe or obtained from a machine shop. One bushing is tapped with a ¼-inch pipe tap and the other has a ½-inch hole for the copper tip. The outside diameter of both bushings should be 15/16 inch.

The brass tube 1-inch O.D., 15/16 inch I.D. and 4¾ inch long may be faced off in a lathe or a file may be used. The ½-inch copper, 6 inches long, is filed to a wedge-shape on one end. The other end has a 3/16 hole drilled in it near the end for a 3/16-inch stove bolt. This bolt is to hold it firmly in the brass tube. The stove bolt should be finished to a length of 15/16 so that it will be a snug fit inside the brass tube. This detail is shown in the assembly drawing.

The copper should then have the front bushing placed about 2 inches from the wedge end, or in any case to leave enough room at the handle end of the heating element so as to allow the lead-in wire to be taken through the gas nipple and handle.

To wind the heating element, put about five inches of asbestos sleeving on one end of the resistance wire, roll



The completed soldering iron with flexible connection cord and plug, ready for use.

a thin layer of mica and then wind on a layer of resistance wire, being careful to keep the wires separated. It will be necessary to have several layers. The layers of wire and mica should be alternated so that the heating element is not only insulated from the copper and brass but so that one part of the resistance wire does not touch any other part.

The last layer should be wrapped with a short piece of iron wire so as to keep the mica and resistance wire in place. Twenty-eight feet of No. 30 Nichrome resistance wire will make a very good heating element. It is not desirable to have an iron heat too rapidly. About five minutes should be required for the iron to get hot enough to melt solder.

The first asbestos sleeving should be anchored under the mica. The other will be on the top layer and should be pulled under the top layer of mica. It has been found best to wind the resistance wire on a spool or block of wood and then wind the heating element directly from this. Care should be taken so that the wire does not kink or snarl.

It should be remembered that the heating element is the main part of the iron. Care should be taken to have all the wires properly insulated and none of the turns touching. The trade name of the mica is No. 1 India sheet mica and must be stripped off in thin layers. A knife may be used to do this and then it is cut to size with scissors. Winding the heating element is the most difficult operation and extreme care should be exercised.

The parts are then assembled as shown in the assembly drawing. The leads of the heating element, with asbestos sleeving, are taken through the ¼-inch pipe nipple and are connected in the handle to the attachment cord.

If it is desired to make the element heat faster, 24 feet of No. 30 Nichrome resistance wire may be used. This will make a 75-watt iron on 110 volts. When 28 feet of wire are used, the heating element will take 50 watts from 110 volts. Either winding should make a good heating element, the 75-watt iron will heat faster but there is the possibility of overheating which will result in a burn out of the element if not watched closely.

The small hand tools required in making this electric soldering iron may be found in nearly all supply stores. The bushings are held in place by 6/32 machine screws. A No. 36 wire drill may be used to drill the hole and then tapped with a machine screw tap. A small tap wrench will be found desirable with this tap and also the ¼-inch pipe tap.

After the parts are made and assembled, it should be plugged into circuit and heated up for the first time. When smoking hot wipe off the point, dip it into rosin or other flux, and wipe again. Now "tin the bolt" by rubbing the heated point in solder so that it becomes covered with a coat of tin.

A Projector for Your Snap-Shots

How you can throw clear pictures of your snap-shots upon the screen for the amusement of yourself and your friends. It is made out of junk parts, but it is effective just the same.

YOUR snapshots may be projected on a screen in your own home with little expense. With the home-built projector any picture or photo can be flashed on a screen as large as six feet square.

The machine shown here was constructed mainly from a square five gallon oil can and an ordinary reading glass.

Bill of Material

The complete bill of materials needed in building the photo-projector follows:

One 5-gallon auto oil can.

One reading glass, 3, 3½ or 4 inch diameter.

Two 100-watt bulbs, with porcelain sockets.

Four stove bolts for same.

Two small hinges.

Three wooden spools.

Three stove bolts for same.

Eight feet lighting cord and plug. Tape, felt, paint, etc.

The lid is removed with a soldering iron and screwdriver, and the handle and spout are taken off. The can is then cut off to 6½ inches and the top replaced. This makes a box 6½ x9½x9½ inches.

A window is cut in the back 5½ inches square and the edges of the hole reinforced with strips of tin to make the back solid. A tube of the same metal is made for the lens draw tube, 4 inches long and just large enough to slip the lens in. Surgeons' tape on the lens rim will make a light, tight job.

The draw tube guide is an inch long, just large enough for the draw tube to slip through. It also is lined with tape or thin felt, glued in to make a good fit, as the draw tube is slid back and forth when focusing. The draw tube guide is soldered in the exact center of the front of the box and the hole is cut in the box after the guide is in place. The rear door is made ¾ of an inch bigger than the window and is hinged with small brass hinges, which are soldered on.

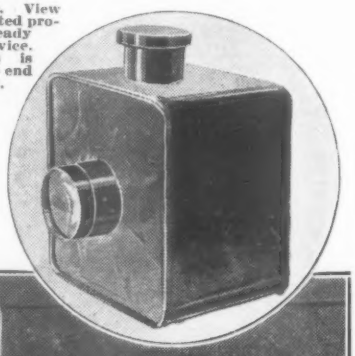
The snapshot carrier is simply a trough of thin metal ¼ in. deep and as wide as two hacksaw blades. Clamp the tin over the saw blades to get a smooth job, then remove the saw blades. This carrier is soldered near the bottom of the door. No other support for the picture is needed; it will lie flat against the door.

A ventilator is provided to prevent overheating. This is 2½ in. in diameter and 3 in. high. The top must be soldered on this and the hole cut before it is mounted on top of the projector. Notched edges on the top of this ventilator tube allow the heat to escape under the lid, which is the top of a convenient can. A 1-in. hole is made in the bottom of the projector to allow the air to rise freely.

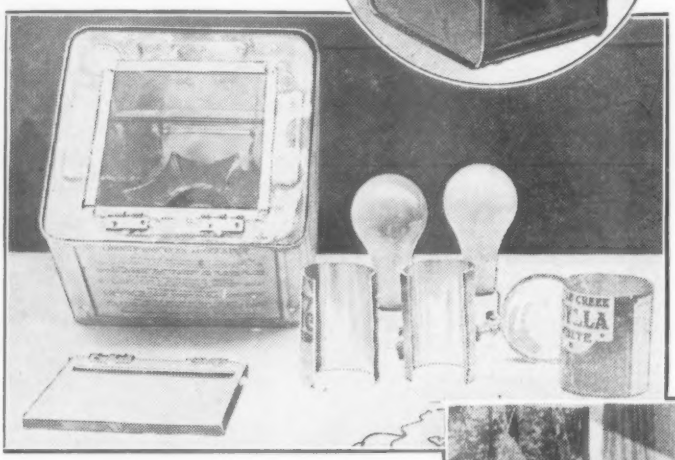
Porcelain light sockets are mounted in the front corners as shown, as near the corners as the bulbs will permit. The reflectors are polished tin, bent to cling to the bulbs. Two coats of black lacquer are put on, inside and out. The lights are wired up and several feet of extension cord, with its plug, is provided. Spools form the legs, one in front and two behind.

To use, set the projector on a table about ten feet away from the screen, which may be a sheet, window blind, or square of plaster board. Darken the room and turn on the projector lights. Now slip a photo or picture in the carrier slot upside down and close the door. Grasp the draw tube and slide it out or back until the projected image is sharp on the screen. No further adjustment is needed until the projector is moved to another location.

Colored pictures are especially brilliant on the screen. If it is desired to show printed matter, the projector must be behind the screen. In this case, a sheet is used, hung in the doorway, and the audience must be in one room, the projector in the other.

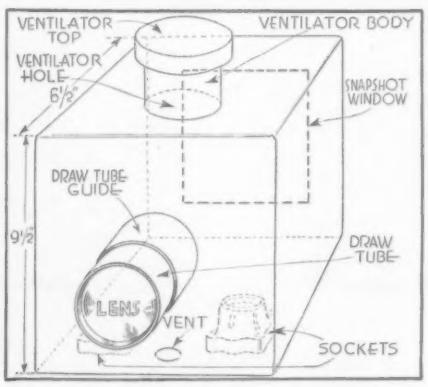


In Circle, View of completed projector ready for service. The lens is set in the end of the can.



At Left. The component parts of the snap-shot projector before assembling. The parts are few and simple.

Many pleasant hours can be spent, displaying your snap-shots and those of your friends, upon a screen. You will be surprised at the clearness of the projection.



Working sketch of the projector showing location of parts.

What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments in the amateur field.

Good Work, Boys—Good Work

WELL, well, well! You fellows certainly made a noble response to my call for more photographs. After the July issue was mailed out, the photographs and specifications came pouring in once more, and now I have a wonderful collection. Thanks, fellows!

Ain't This Somethin'?

HERE is the latest development—a "fool-proof" plane built by Arnold Holden, Bucyrus, N. Dakota.

It cannot get into tailspin, nose-dive nor any other accident. It absolutely will not have any engine trouble in any kind of weather and has a landing speed of one hundred miles per hour.

It can be made into a high winged monoplane or a "low winger" by putting on different wings. This is very handy as it will only take up a small

The intrepid pilot standing by for orders.

place for storage. The low-winger has a wing spread of 14 feet and the length of the plane is 10 feet. The high-winger has a wing spread of 12 feet.

The color of the plane is a bright orange with Royal Blue trimmings. It only weighs 200 pounds and has a removable cowling.

This plane is very economical for the complete plane cost Arnold about $20.00 and it doesn't cost a cent to run, for it is only a big non-flying model plane, which looks exactly like a real airplane.

He has fooled many people who drive by. They see it, stop and ask him how much he'd want to take them up. They sure do get fooled when they find it has no motor. Arnold would like to buy a motorcycle motor or a real good washing-machine engine to put on it so it can pull itself along the ground. Maybe a compressed air motor would do in this case.

EDITOR'S NOTE.—In presenting this amusing sketch, we faced a problem. That is, whether it should be placed in this department or in the Model Section presided over by Joe Ott.

A High School Instructor Built This Ship

This is one of the neatest jobs—so far as workmanship goes—of any of the lightplanes submitted to us. Looks like a factory production job.

THIS is a story of how a high school instructor, C. W. Amundsen, Worthington, Minn., showed his students a few tricks on the field as well as in his classroom. Mr. Amundsen is the Instructor of Industrial Arts at the Worthington High School.

This ship was built after the design of B. H. Pietenpol, Spring Valley, Minn., and while only powered with a Ford Model "A" engine, it flies two persons with ease at a top speed of 95 m.p.h. It has a landing speed of about 35 m.p.h. and has a cruising range of 200 miles on a 12-gallon tank of gasoline.

Mr. Amundsen made his solo flight in this ship after seven hours of instruction, and many other beginners with only a few air-hours to their credit have flown it without difficulty. Experienced pilots have pronounced it a fine flying airplane.

It's Hot for Ice Boats, But—

ICE boating with a propeller driven boat is a lot of sport and we are glad to publish the picture of the craft built by Fred W. Engels, Highland Falls, N. Y.

The constructor is in training for an airplane mechanic's job and is hopeful. He is a graduate of the Stewart Technical Aviation School of New York City, and this rather accounts for the excellence of the job that he made of his ice-boat.

A mighty cool looking subject that is refreshing during these hot August days. Introducing Fred W. Engels and his ice boat.

These Boys Did a Lot of Work

The training glider in flight.

WE HAVE a pleasant letter and some photographs of a glider from S. B. Stover, 734 Park Ave., Plainfield, N. J. Read—you fans—what Mr. Stover has to say:

I am the owner of a PT-2 glider, built by us in 1930. *It was pancaked on its third flight by the designer (not the writer), hibernated for the winter to put on a new and heavier skid and also a nacelle. In the interim, the designer amputated the nose of an old Nieuport and made a real heavy training glider mounted on motorcycle wheels and axle.*

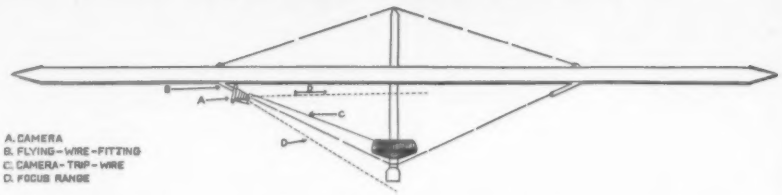
It was an ideal "hop, skip and thump" affair, too heavy and fast for any altitude over ten feet on our small field, but it did faithful service through the early part of 1931 *until a large chuck hole wiped off the landing gear and wing struts. By this time the converted primary was ready and a real object of pride and joy with plenty of work thrown in—for four months, at least, of* 1931 *we were able to pile up well over* 300 *short ten to twenty second straight-away hops with safe landings.*

Nothing more serious than a split plywood seat from a nose and tail spanking when landing up a slope one time. Have worn out two runners hauling back and forth from barn to field over 500 *yards of dirt road every weekend. Along about December we dismantled and stowed the glider in the barn. But now, clear, warm, breezy weather is here again.*

The group has dwindled to three—myself, my younger brother and the young farmer on whose property our field is located—and we are getting uneasy over wasted time. Before we assemble I am going to get new flexible control cable for the aielerons and recover the wing panels for the present covering has gone through two seasons.

Showing the nacelle mounted on the training glider.

Photographing Yourself on Your Glider



A STANDARD camera, a few straps, some fine steel wire and a half hour's time is all that is needed to rig a camera on your ship.

You will have the thrill of your life when you climb to a 500 foot dive, roll into a sharp turn and pull the trip wire. "Presto!" Your photo is taken 500 feet off the ground in a glider with you probably sitting on an 18 inch seat smiling.

Photo taken while in flight.

Any good camera with a fast lens can be used, providing the shutter can be operated from the seat with a fine wire. Kodaks work very well, as they have splendid shutter trips. The camera should be fastened on the flying wire fitting with straps and lined up so that it is focussed on the pilot's seat. After it is lined up properly the camera should be securely fastened to the fitting to prevent it from moving, which would blur the photo.

A length of fine steel wire should now be fastened to the shutter on the camera in such a way that it will snap the camera when pulled from the pilot's seat. The pilot can fasten the wire in the most convenient and easiest place for him to reach when in flight.

A bright sunny day should be chosen for taking the photos, and care must be taken not to have the lens facing the direct rays of the sun when flying or else it would result in a total failure. From 100 to 600 feet is the best altitude for good results and the ship must be put in a 20 degree bank in order to get the ground in the picture.

A slight pull on the trip wire is all that is necessary to operate the shutter, and only one picture can be taken at a time, that is, one each flight.

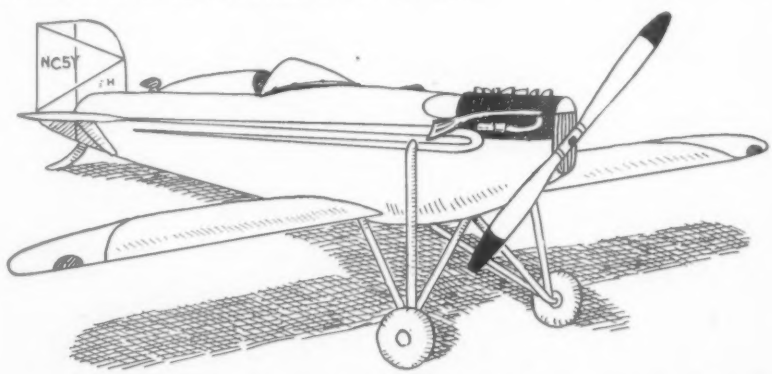
Another plan, and probably a safer one than shown to this point would be to obtain a length of small rubber hose from the druggist and extend the bulb pressure line where a bulb air release is used on the camera. However, this is largely a matter of personal taste and can be worked out in a number of ways.

Looks Like a Promising Monoplane

JOSEPH HARTMAN, 4140 Ottumwa St., Ottumwa, Iowa, is the designer of this model airplane. He plans to make a full sized ship of it.

The ship is to be powered with a Michigan Rover engine, capable of delivering 75 h. p. The top speed of the plane is estimated at 120 m. p. h. with a landing speed of only 20 m. p. h.

The plane as shown in the illustration, is a very neat job, well designed. We hope to hear before long just how the ship performs. The information will be passed along as soon as it comes in.



The artist makes a sketch of Joe Hartman's dream ship, and it is a mighty good looking ship at that.

The Down-draft is Dangerous

THE accident to the airship Akron on Washington's birthday has centered attention to one of the most feared of weather phenomenons—the down-draft.

Since the first rigid airship was developed by Count Zeppelin, more than 30 years ago, this problem has defied solution. Even though it is comparatively rare, it is serious enough to keep airship experts at high tension during docking and undocking operations.

When a gusty wind strikes a great bulk like an airship, weighed off to be about equal to the air it displaces, and with the ship close to the ground, there is danger of real disaster. Engineers of the United States Navy have gone further than any other group in the world toward the creation of mechanical appliances for handling airships on the ground, but none of them is satisfied that he has yet whipped this down-draft menace.

In the matter of handling, airships are a good deal like ocean liners. On the sea, even today, the job of warping an ocean liner into her dock and getting her out again, calls for the use of many tugs and the greatest handling skill.

Because of the improvements in mechanical equipment at Lakehurst, docking and undocking have been carried out in winds having almost double the velocity at which it was safe to handle the airship with ground crews. But the engineers are still working against that down-draft. They must evolve a method of vertical control against these down currents which throw an airship to the ground and then bounce it high up in the air.

A method for exerting a vertical pull upward, perhaps by means of a high moving tower with lines extending to strong points in the airship's frame along the top, is being sought.

A Lioness Takes to the Air

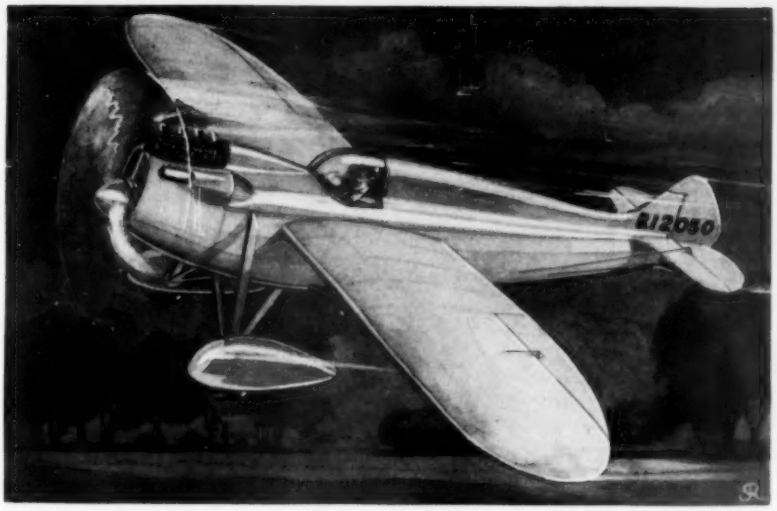
MITTIE is a young lioness that was captured when a young cub in lower California. She has been brought up as a family pet and is very tame.

And now she has become air-minded! She takes almost daily trips with her master, C. Colless, and will whine with eagerness until she is assured that she is going.

New Practical Speed Record

HOW fast is the progress of aviation was emphasized recently by the flight of a test pilot in a day bomber from Gosport to Brooklands, England, at a speed averaging 300 miles an hour. But it was not so much his rate of travel as the fact that the 52-mile flight was made in the teeth of a 100-mile-an-hour gale. Even with that wall of wind against him, the pilot, (P. E. G. Sayer), flew the 52 miles in a few seconds more than 10 minutes.

A Church Mid-wing Monoplane With Enclosure



The Church Monoplane that is particularly adapted for speed contests and which is entered for many 1932 events.

YEAR after year, the world famous National Air Races carry on their activities, this year to be held at Cleveland, Ohio, where the finest in aircraft is displayed. Imagine the tremendous thrill for any boy, man, or girl to compete in any of the races of what is considered one of the largest sporting events of the year!

Many fans throughout the country plan each year to enter their home constructed planes in the All American Speed Dash, closed course speed races, efficiency tests, spot landings, etc., and many finish the week of thrills many hundred of dollars richer.

It has been generally believed in the past that these races are held exclusively for manufacturers, but this is not true. Most of the events are free for all except the Army and Navy maneuvers, and it is rumored that special student races; i.e., private pilot races, are being planned to create even a greater interest.

It is unfortunate that certain political factions have been partially successful in temporarily halting the progress of the most interesting and educational of hobbies, that is building lightplanes for sporting use, but like prohibition, it is only an experiment.

The Church Airplane & Mfg. Co. of Chicago, Illinois, like other lightplane and motor manufacturers, look for serious competition from the home-builder, in fact, several Church Marathon J-3 Engines have been purchased for this specific purpose. Never before in the history of this company have they attempted such speed as is contemplated for this year and still maintaining the ease of operation and safety for the pilot. Unceasing experimenting and study have at last rewarded the Church company in the production of a sturdy, fast and reliable ship.

Fortunes have been spent, some sadly wasted, but most have been spent wisely in the development of a dependable and powerful engine for light planes.

The Church Airplane & Manufacturing Company's engineers have completed exhaustive tests on the Marathon J-3 Engine in their new laboratory where instruments are now on hand to detect every action of the engine under full power. The newly constructed Hydraulic-Mercury Torque Stand, records horsepower readings down to one-tenth of one horsepower. This type of equipment is approved by the Aeronautical Branch of the Department of Commerce.

One of the stock J-3 Engines was used in the 1931 Church Mid-Wing entries developing 41 h.p., and caused a sensation that year, actually defeating by 18 m.p.h. all other 115 cubic inch entries, but through a misunderstanding was forced into second place. This year, it is hoped no such misunderstandings will occur.

In line with the wonderful progress in all types of modern aircraft this company is now completing plans to produce four types of planes, two single-place, and two, two-place planes within reach of all, built around this famous 46.5 h.p. motor, providing there is no cheap political interference. Announcements will be made soon.

Artificial London Airport Proposed

LONDON people are proposing a roofed-over landing field to cost about $36,000,000, situated between Waterloo Bridge and Charing Cross Bridge. This is in the heart of London. The plan has been advanced several times during the past 10 years, but is now revived. Those who are familiar with London will recognize the excellence of the proposed location in comparison with distant Croydon.

ENLARGED MODEL DEPARTMENT

New Ideas for Our Model Builders

New model building and flying stunts gathered from far and near for our readers.

Here is Something Brand New

This housefly model sure looks natural.

ALL sorts of models have arrived in this office, scale models, stick models, and others, but this is the first time that we have heard of a flying model of a house-fly!

Prof. T. N. de Bobrovsky, 4 Cubberly Place, Jersey City, N. J., is responsible for this latest novelty. It has a span of two feet, and is driven by a rubber motor placed inside of the fly's fuselage—or whatever you call it.

This Glider is Nearly Full Size

HERE'S a genuine giant size model of a glider built by Stanley Congdon, 200 Linden Ave., Glen Ridge, N. Y.

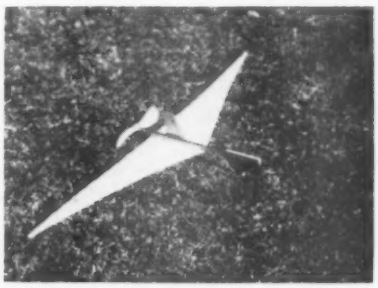
According to the information sent by Stanley, it has a wing span of 13 feet with a six-foot fuselage. It weighs five pounds and has made 75 flights of from 200 to 2,000 feet.

JOSEPH OTT, our Model Editor, wishes to thank our readers for the many new stunts and suggestions that came pouring into the office after his announcement in the July issue.

Now, he wishes it understood that the same offer still stands open, and that he stands willing to give $1.00 and 15 full size model drawings for every contribution that is published. Just do a little thinking, scribble the results down on a piece of paper and hand it in. Very likely, it will be published.

If you know of an easier and better way of doing a job, if you have designed some new sort of model or an accessory for a model that gives better performance—just send it in to us, care of Joe Ott, Model Editor, POPULAR AVIATION, *608 S. Dearborn St., Chicago, Ill.*

The Pterodactyl is Tailless



Here is the Pterodactyl model.

IT CERTAINLY seems good to hear of so many original model designs. Here we have a tailless flying model, based on the prehistoric flying lizard known as the Pterodactyl.

Its builder, Hartley Jenkins, age 13, La Mesa, Cal., says that the model is not very easy to launch, nor does it give good duration, but that it flies wonderfully well. The leading edge has a sweepback of nearly 30 degrees. Well, Hartley, this is certainly fine, and we appreciate the excellent photo.

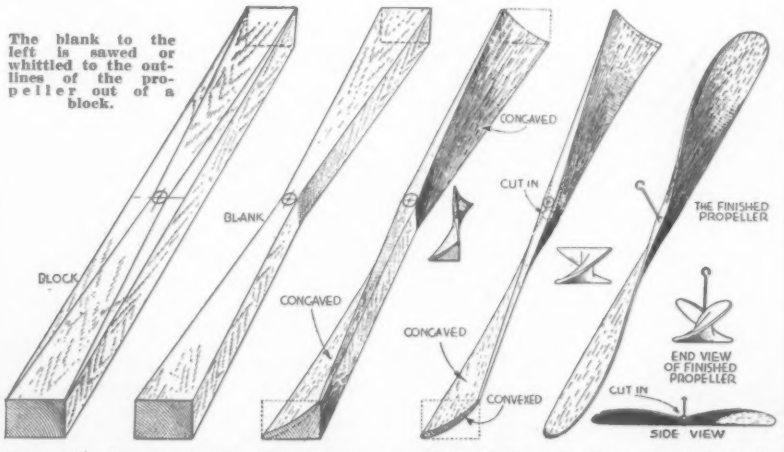
How to Carve an Efficient Model Propeller

SECURE a block of the correct size. This dimension is usually given in the text accompanying the model article.

Lay out the block and cut out the blank form. Carve the inside faces first. Sand and finish completely. Try to keep both inside faces alike.

Carve the back. Make a paper pattern for the shape desired. By the use of a pattern, both blades will come out exactly similar.

For duration models make very thin. For scale models leave blades fairly heavy. Balance blade in two positions at least.



Progressive drawings showing how to carve a propeller, starting with the rough block at the left and finishing at the right.

A Stinson-Lycoming Model

A Stinson-Lycoming to the very life.

STEPPING out of the beaten trail, William Drake, Malden, Mass., together with his friends, Paul Fass and Elwood Hathaway, has built a 32-inch model of the Stinson-Lycoming monoplane. It was built for advertising purposes.

As the photograph shows, this is a well designed and constructed model that reflects great credit on its builders.

Laird Super-Solution is Next

A front view of the Laird Super-Solution shows careful workmanship.

A FLYING scale model of Doolittle's Laird Super-Solution has been successfully built by Eugene L. Davis, Sidney, Neb. It is made to a scale of ¾ inch to the foot.

The photograph shows that every part of the job has been carried out to the smallest detail.

He Builds a Spad

Here is the Spad just after launching. A well built and excellent flying model.

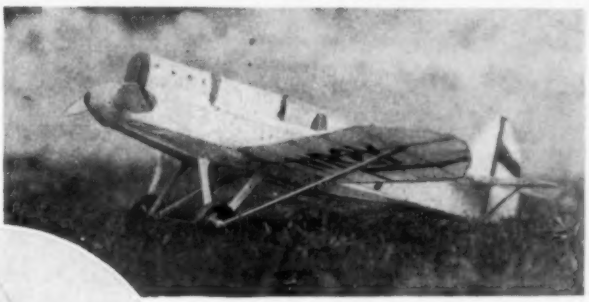
DOWN in Indiana lives a model fan who has about 25 flying scale models that he has built, the sizes ranging from 14 to 60 inches wing span. This is Gordon A. Nesbitt, 1722 Central Ave., Anderson, Ind.

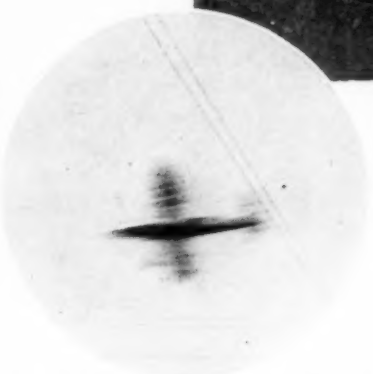
The photograph above shows a 24-inch flying scale model of a Spad. He says that it flies much better than expected for it has no dihedral. The model averages flights of about 150 feet at a height of from five to ten feet.

This Howard Racing Model is Certainly an Attractive Job

At the right is a beautifully constructed scale model of the Howard racing plane.

Below is a snap-shot of the racer in flight showing speed.





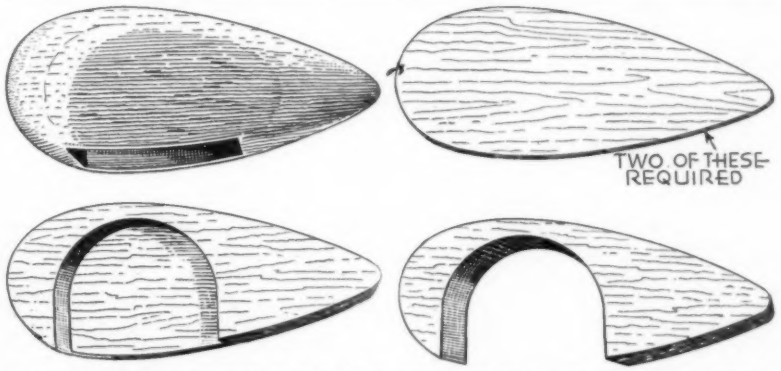
AN INTERESTING letter and photographs were received from William C. Eymann, 609 Riley St., Atchison, Kas. He writes:

Enclosed you will find several pictures of a model of my own design and construction—a Howard Racer. The picture of the model flying is real—not posed. You can readily see from the photographs that the model flies much too fast to photograph.

The model in the picture has a span of 20 inches, an over-all length of 17¾ inches, a chord of four inches. Everything is exactly in scale to the fraction of an inch. Even the wing section is duplicated from the large model.

The model has a speed of approximately 30 miles per hour and a "cruising range" of 200 yards. Duration, on account of its speed, 15 to 25 seconds.

Making a Pair of Pants for Your Scale Model



At the left, the pants are made in two halves, grooved out for the wheels. At the right is a three piece job, a center portion and two outside plates.

The average model builder often finds the wheel pants a problem when he is constructing a scale model. However, the problem is a comparatively simple one if attacked in the proper manner, and the result is just as good as the "boughten" wheel pants if a little care is taken.

Now at the left of the drawing above, is shown a method of making the pants in two pieces. Two strips of balsa are sawed out to the proper outline, and both halves are grooved for the reception of the wheels. The outside is whittled down to an oval form, and then the halves are fastened together to form the completed job as at the top and left of the drawing.

At the right, is a three-piece wheel pant job. The center part is sawed out to receive the wheel, as at the bottom of the right hand detail, and then two thin plates of balsa are fastened to either side of it.

Flapping Wings

J. H. MONTGOMERY, Los Angeles, Cal., has studied the flight of birds for more than fifteen years, and at last has built a model ornithopter that flies on the same birdlike principle.

Building the "Baby Scout" Duration Model

(See Drawing on Opposite Page)

Here are the complete description and drawings for building this 90-second duration flying model as designed by

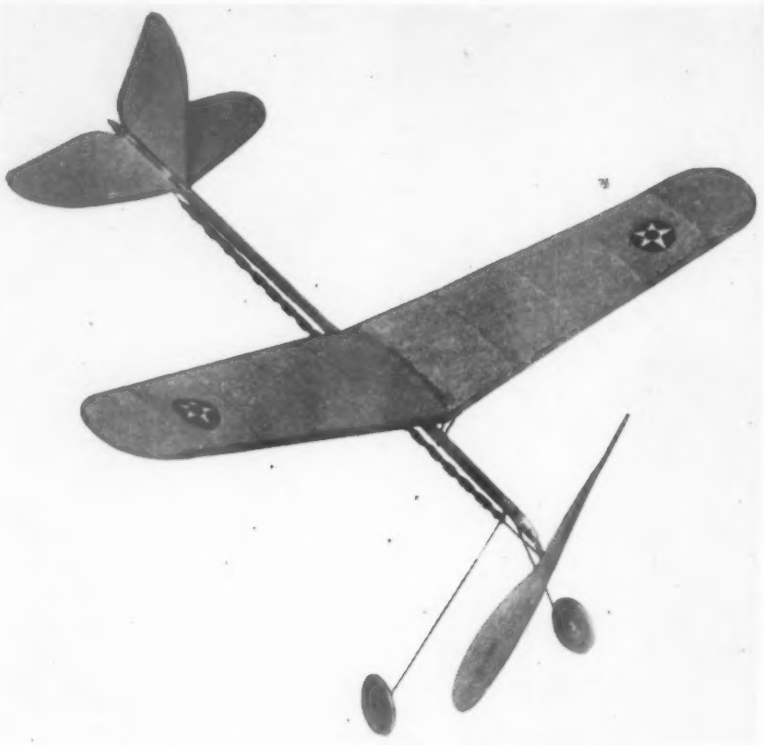
POP STICK

DO YOU wish to build a simple model airplane—simplicity itself—and yet one that flies well and has a duration of from 60 to 90 seconds? Well, here it is—the "Baby Scout" tractor with a 15-inch wing spread.

An examination of this model will show that the body is simply a backbone of hard balsa wood—a simple stick—the tail is outlined with bamboo, which is unbreakable, and the surfaces are covered with a thin light grade of tissue paper.

The main wing is covered on the top side only with the ribs square cut to the shape shown by the side view. It is not necessary nor even desirable to apply "dope" nor any other varnish or compounds to the covering.

A simple method for tightening the covering is adopted. After covering, the wing is held over a kettle of steaming water. When cooled off and allowed to dry, the paper shrinks and thereby becomes sufficiently taut for our purpose.



The completed "Baby Scout" Duration model—ready for flight.

Body or Stick

THE body is 12 inches long, 3/32 inch thick and 3/16 inch deep. Preferably, secure a hard piece of balsa. Prepare the front end to receive the thrust bearing which is cemented and dried in place with silk thread. The rear hook and skid is one piece and should also be cemented and dried into position.

The model has a 15-inch wing span and the sizes in this article are given in proportion to this span. The stabilizer is six inches from the outer edges and two inches deep. It is advisable to draw an outline on paper to full correct size before bending the bamboo, this drawing being a guide to bending.

If the tail parts are made up of straight balsa pieces, the tips may be secured with the corners slightly rounded. Care should be taken so that the tail unit is not warped before the covering is cemented in place.

Landing Gear

THIS landing gear is a simple piece of wire bent to pass around the body and is then cemented in position. Its height is just sufficient to allow clearance for the six-inch propeller. On the lower end of each side, that forms itself into the axle, a small square bend is made. This counteracts the tendency of the wheel toward sliding away from the required position.

The wheels are one inch in diameter. They should be made up of two thin pieces of 1/16 inch sheet balsa. Small washers may be cemented on each side of the discs to prevent wobbling. The wheel is prevented from coming off the axle by applying a small drop of cement on the outer end.

Propeller

THE propeller block should be six inches in diameter, by ⅝ inch thick and 1½ inch wide. This model will fly with any type of propeller either high or low pitch. All the wire fittings are made of .016 diameter tinned piano wire. The motive power is two strands of 30 gauge ⅛-inch flat rubber.

Wing

THE wing is built up of four short spars which act as the entering and trailing edges at the same time. The tips are bent bamboo. The widest part of the wing is 3 inches in the center. It then tapers down to two inches at the last outer tip rib. The ribs should all be cut out at the same time with the same curve and the same length.

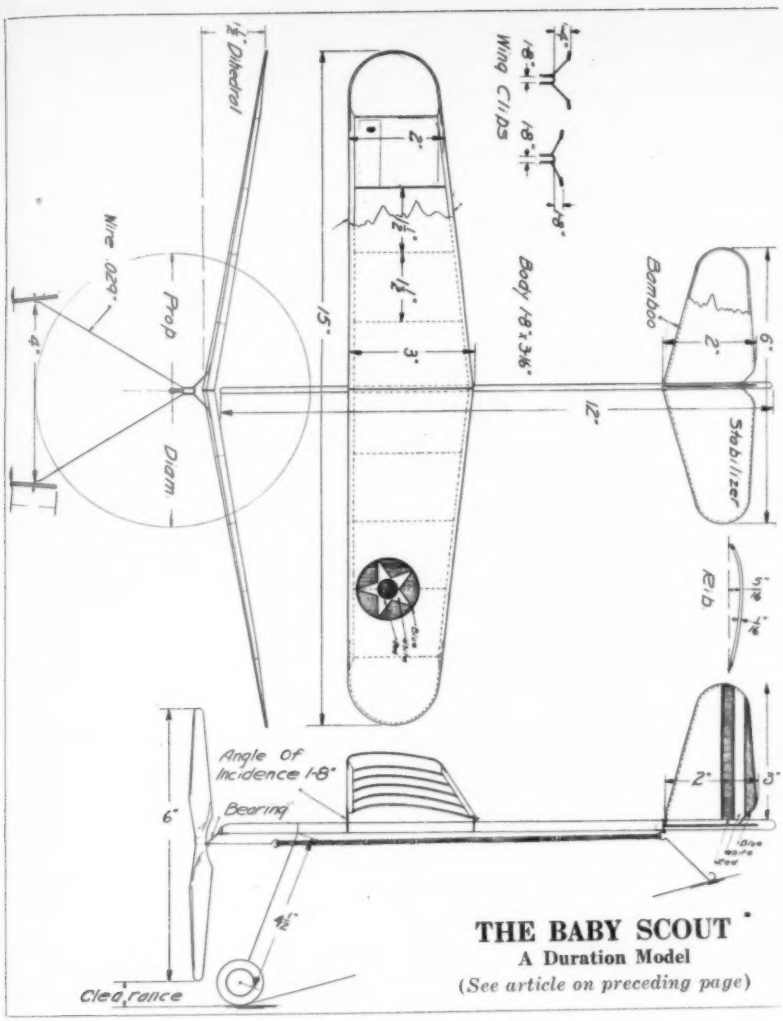
When the spars are laid down in position, the center rib and the end rib should be put in first. The three intermediate ribs should then be made to fit as required. The front part of the spar, acting as the entering edge, should be rounded off on the front and left flat at the back or inside. The thickness of the wing is equivalent to the thickness of the rib, cemented directly to the edge.

After the left and right halves of the wing have been completed, they should be jointed at the center, allowing two inches of dihedral on each side.

While the wing is drying, the clips should be bent to shape as illustrated. When cemented in place they will give additional strength to the wing. Care should be taken in making sure that the clips do not throw the wing out on the left or right side.

The propeller and landing gear bring the center of balance of the model quite far forward, and the position as shown on the side elevation should be approximately correct for the finished flying model. Because of the extreme lightness of this model, it is not necessary to show more than ordinary care in flying.

The model flies very slowly and very little, if any, damage will be sustained when landing head on or against walls. When built correctly the model should be capable of flying sixty to ninety seconds.



THE BABY SCOUT
A Duration Model
(See article on preceding page)

Use of Rubber in Aeronautics

RUBBER, while not being particularly desirable within itself as a constructional material, is still used extensively in aviation. In spite of the fact that it is an organic material, and thus subject to decomposition, this is offset by certain desirable characteristics that have not yet been discovered in any metal or mineral product.

In the first place, rubber is still used extensively as a spring in the landing gear of airplanes and for their tires. Rubber is chosen first for its light weight, and secondly, for its peculiar property of "hysteresis" or high internal friction. Steel springs, while they can be made to absorb shocks, have so little internal resistance that they recoil and continue to vibrate for some time after the force has been applied. Rubber springs, on the contrary, come to rest almost immediately after the force has been applied because the internal friction of the rubber damps down all tendency to vibrate.

Where steel springs are employed to break the force of taxi jolts, some damping device or shock-absorber must be used in addition to take up the recoil. This requires the use of oil filled dash pots, oil checks and similar devices that increase both the weight and the complication of the landing gear. On small airplanes, where simplicity and low cost are the leading features, rubber is used extensively for springing the wheels.

The fact that rubber can store more energy per pound of weight than almost any other known material, makes it useful on the landing gears as well as for a motor on model airplanes. One pound of rubber can store a great deal more energy than a pound of steel springs, a fact that will be confirmed by any airplane model builder who has attempted to use clockwork motors with steel springs in place of the more usual rubber motor.

What Is Balsa Wood?

MOST balsa wood, so necessary in airplane manufacture and model airplane making, comes from the forests of Ecuador. This does not mean that it grows only in one part of the South American hot country, but that Guayaquil is, at the present time, the most convenient port of shipment to foreign centers.

In some parts of tropical South America the balsa raft is the only means of transporting freight. By the way, *balsa* is a Spanish word meaning "raft". It is pronounced "bal-sa", not "bawlsa". The rafts of the interior all follow the same general design, which is very ancient. Ten-foot balsa poles are fastened together with long pegs made of palm-wood, which give the raft flexibility. In the rocky shallows and the turbulent rapids a rigid craft would be smashed to pieces.

If the balsa is intended to carry heavy freight such as machinery for gold mining or for the coffee-and-cacao-plantations, it is enlarged by the simple process of lashing several of the ten-pole rafts together. They are held in place by saplings laid crosswise and tied with strips of fresh balsa-bark. This kind of barge is called a "*callapo*" and will carry as much as one and a quarter tons of freight, plus the crew of several men. If passengers are to be considered, a bamboo platform, on stilts, is placed in the middle, because balsa rafts are always awash.

Along the shores of Ecuador and on the Guyas River — where Guayaquil stands, thirty-six miles from the sea— the traveler may see the Indians poling or paddling their balsa-wood rafts laden with native produce. In the open ocean the fishermen use a large, two-log, balsa raft. It gives one a distinct shock to see one of these men drive his awkward, big craft ashore through the surf, and then pick it up in one hand and carry it up to the fishing village as though it were no more than a bag of peanuts.

Balsa wood is being used commercially in many ways. Aside from its importance in the airplane industry and in model making, it is a valuable shock-absorber for packing pianos and fine furniture, and for foundation pads for machinery. Its insulating properties make it valuable for lining refrigerators, incubators and cold-storage rooms; and because of this insulating power combined with lightness, it is used for shipping-containers for dry-ice. Balsa, for such purposes is made moisture proof by impregnating it with paraffin wax.

Boeing Wasp Is Fast Climber

THE latest Wasp powered Boeing army fighters climb twice as fast, 2,100 feet per minute, as the fastest elevator speed in any office building in the country.

Building the Great Lakes Trainer

by JOSEPH S. OTT

This is a flying model of the well known biplane used so successfully for stunting and advanced training. When completed it will be a model to be proud of.

DURING the past few months, numerous requests have been received for the Model Department to produce a flying scale model of the Great Lakes Sport Trainer. Up to the present, the models chosen have been those that have created the greatest amount of public interest at that time for invariably the model builders desire to build such a type.

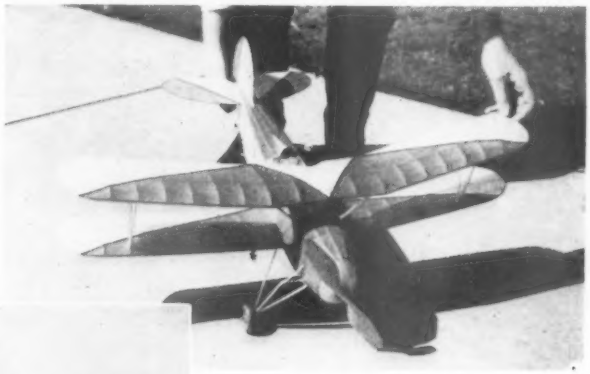
The original test model, built for this article, had a total weight of two and three-quarter ounces and required only a very small additional balance unit at the nose to turn it into a perfect flying model of the Great Lakes Trainer.

The external protruding parts, that represent the motor and the exhaust, were left off but may be added to represent a four cylinder inverted motor having the exhaust pipes extended underneath the fuselage. On this latest model, so little of the motor appears through the cowling, that it was not deemed necessary to add these additional parts to make the model representative.

Note in particular, the side view which shows a large oval shaped nose block with a small button-like plug. This contains a small washer pressed in the front end and cemented into position to act as a thrust bearing. The propeller shaft is put through the plug, the shoulder of which is square to prevent rotating. Then the shaft is forced through the propeller hole, folded back and drawn into the propeller to prevent slippage.

The three units, the shaft, the plug and propeller are removable. To replace the propeller, the shaft is usually straightened and pulled off, but better still, a new one is put in place. With a small plug arrangement of this kind, two or three different types of propellers may be tried and the one giving the best results can easily be found without any great difficulty of removing parts and making adjustments.

At the right is a part plan view of the completed model showing the decorations. Below is a photo showing the model ready for its test flight.



ABBREVIATED BUILDING INSTRUCTIONS

1. Make two body sides.
2. Finish the top and lower sides of body.
3. Add the top cowling.
4. Add the lower cowling.
5. Put on faring strips.
6. Make the nose.
7. Build the tail units.
8. Make the landing gear, all bamboo.
9. Cut out all the ribs, 21 required.
10. Assemble the wing.
11. Make the "N" struts.
12. Attach top wing and center section struts.
13. Attach lower wing and outer base struts.
14. Make propeller.
15. Balance model.

LIST OF MATERIALS

Longerons—3/32x3/32x30—10 pieces.
Nose Block—1x2x4.
Propeller—¾x1⅛x1.
Cowling—1/32x2x24.
Rib Stock—1/32x2x24—2 pieces.
"N" Struts—⅛x¼x24—2 pieces.
Spars—1/16x⅛x30—4 pieces.
Entering Edge—⅛x⅛x30—2 pieces.
Trailing Edge—1/16x3/16x30—2 pcs.
Bamboo—1/16x¼x15—8 pieces.
Rubber—1/32x⅛x15 feet.
Fittings—Tinned piano wire .029 diameter.
Washers—⅛" O. D.—3 each.
Wheels—1⅞" diameter—1 pair.
Windshields—Cellophane .010 thick, 2x6.
Tissue—21½x24½—white—2 sheets.
Tissue—21½x24½—red—1 sheet.
Dope—1 large bottle.
Cement—1 large tube or can.

Front elevation of the Great Lakes Trainer scale model showing clearly the construction of the landing gear and the interplane bracing.

DETAILED BUILDING INSTRUCTIONS

Beginning with this month, all the flying scale models that will appear in the Model Department will be dimensioned throughout. In this way a large duplicate necessary to work from may easily be drawn up and completed much quicker than would be the case if only a scale drawing is given.

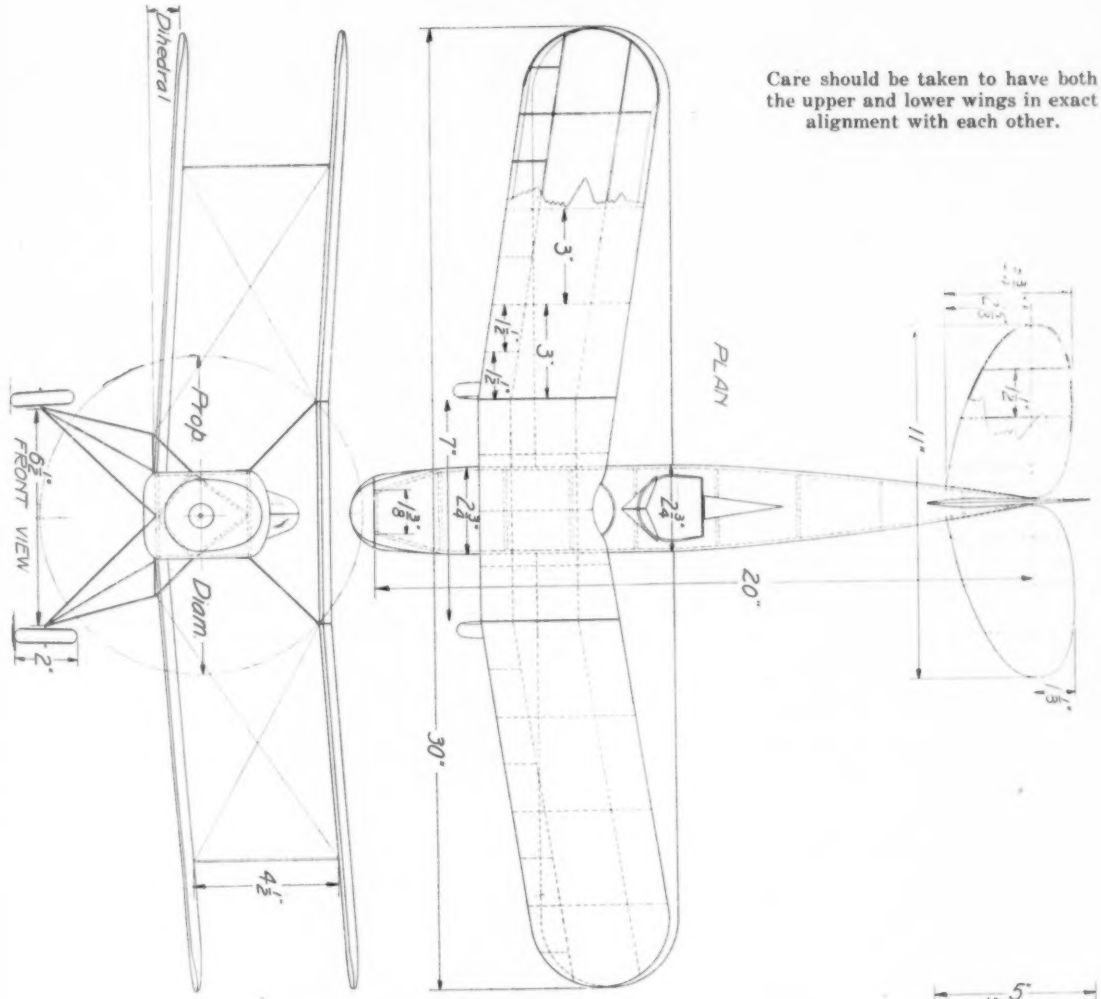
The first step is making the two body sides. After one side is completed, put a piece of waxed paper over the entire framework and make side No. 2 directly over and on top of the first

(*Continued on page* 120)

XUM

Great Lakes Trainer Biplane

A Flying Model



Care should be taken to have both the upper and lower wings in exact alignment with each other.

The propeller clearance is of importance and should be large enough to avoid having the propeller strike when in position shown.

Great Lakes

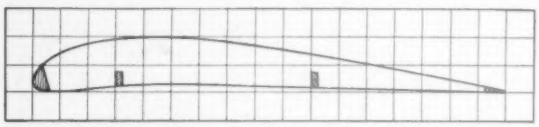
(*Continued from page* 118)

one. In this way, two sides can be built exact. It should not be necessary to make a top view of the drawing after the sides have been completed.

The dimensions are given at the widest point and the upper and lower cross-pieces being alike, the width towards the tail part may be worked in progressively. First by drawing the two end pieces together and spacing the additional cross-pieces as required. This will save time and work, which is a very important item, and help to bring the model to a finish sooner.

The top and the lower cowling should now be added and sanded to conform to the body as shown in the front view. The nose block should be cut at this time. The heavy line represents the widest section, also shown on the front view. The propeller plug is shown round on the front view, but the shoulder itself is square.

After the nose has been fitted and the cowling made to conform, the fairing strips are added to the first cowling former to the front of No. 1 cockpit. Three fairing strips in the top side are sufficient. Three should also on the bottom of the fuselage. The cockpit section should be covered with thin balsa and then the cockpits may be carved out to conform to the top view.



Full size wing section drawn on squared paper.

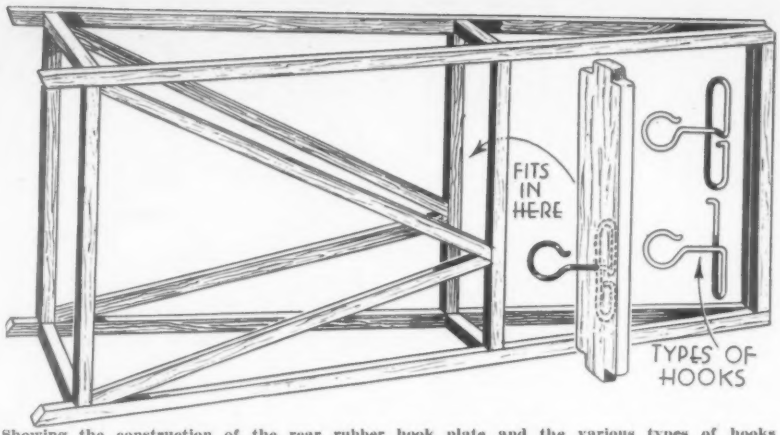
The front cockpit is circular in form and the rear cockpit is flat, meeting at the top body cowling. The head rest should be added after the body has been covered. Use three fairing strips to the rear of the cockpit.

The outline of the tail units are bent bamboo and the approximate cross section is 1/32x1/16. The exact length can be reached by using a fifteen-inch bamboo strip.

Allow about an inch to project beyond the amount required at the beginning and after the proper form has been secured by bending in a conventional way over a candle flame or some other type of heating unit. When bending bamboo, shave off the inside, or the soft part, and always bend in the full width, then trim small sections off of the large piece.

By trimming the small pieces from the large piece, after it has been bent, the thin edge or the 1/32 inch side will strike the air and help to streamline these parts. The original piece should be approximately 1/16 inch thick and this will be the depth of the bamboo edge.

A full size rib drawing and pattern is illustrated, drawn on a background of squares. These squares represent a quarter of an inch and the exact scale for the 30 inch model is easily secured by multiplying these units to their correct size. Twenty-one full ribs are required for both wings.



Showing the construction of the rear rubber hook plate and the various types of hooks employed. This is strong, light and easily removed.

On the top wing, the spars should be on the lower side. On the lower ribs the spars should be on the top side. In this way a solid and firm joint is secured when the struts are cemented to the wings. When placing spars on the top side of the rib, if the ribs are spaced far apart, the top surface of the wing takes on the shape of an angular section when the paper strikes or meets the spar. This is more noticeable at the front spar, and to offset this condition, a small nose rib is employed between each main rib.

When assembling the top wing, include a small amount of dihedral, which will tend to give the model better stability. The original large plane does not have this dihedral, but in the model it is always best to employ a small amount.

The wings are covered from the wing tip to the front part of the center section having red to the front and white to the rear. The tissue is cemented together before being applied to the framework. A weak solution of dope or light banana oil should be used to prevent the tissue from shrinking and creating wrinkles before being stretched on the frame.

Both wings are the same on the top and entirely white on the under side. A small black stripe, ⅛ inch wide, is cemented over the joint where the two colors meet. The body is entirely red with 2/3 of the under side in white. The tail follows the same color scheme as that of the main wings. Do not apply dope on the wings or body. Spray with water and allow to dry, which will be sufficient to draw the tissue up very taut.

Doping a wing invariably warps the entire model out of shape, if not immediately, after it has been in a warm room after a few days. However, the body being very strongly braced with cross members, and as this model employs no motor stick, one light coat of dope can be safely applied on this part.

When attaching the wings to the body the "N" struts must be prepared in advance and the overall length of the center section strut is three inches for the 30 inch model. The wood parts should be stream-lined before cementing together to the "N" form.

The leading edge is re-enforced with a small piece of bamboo which in turn is longer than the strut itself continues in through the wing on to the rib. The lower end that touches the body continues along the strut so that additional surface.

Note in the front view the attachment of the landing gear and where it meets the upright the internal structure of the fuselage is braced additionally to help absorb the side pressure when the model lands.

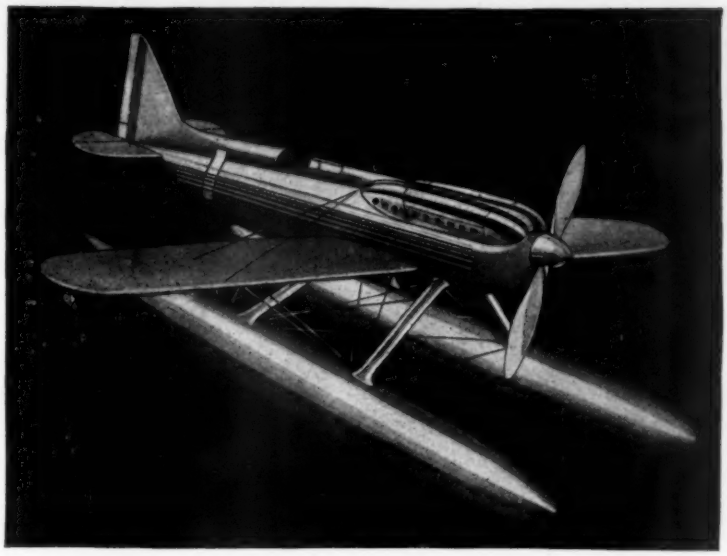
Full detailed instructions for carving the propeller are illustrated in a separate sketch, and as this drawing is completely self-explanatory additional detail information is eliminated.

END

The full size Great Lakes Trainer. Compare it with the model.

Here's the Model you have been looking for— the New Ideal-Designed

S. 6. B. SUPERMARINE



This is a picture of the IDEAL-Designed Model of the Supermarine S.6.B. — Men's Speediest Air Conveyance. Credited with a speed of 408.8 miles per hour. This IDEAL-Designed Model is a faithful reproduction of the fast original. While we cannot claim it will fly like the original, it will give a fine Model performance in the air and is correctly balanced and can be waterproofed for use in smooth water.

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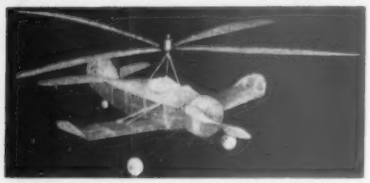

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Man's Power

(*Continued from page 96*)

like a boy's dart for his machine and a longitudinal keel-cloth for equilibrium. His area was .85 square feet per pound or a wing loading of a little over a pound.

Search for a mechanical prime mover would seem the logical step for an unsuccessful man-power experimenter. Quatermain reversed this and, long after failing in his efforts to invent an aviation motor in 1868, wrote the London Engineer in September, 1890, that he was developing a muscle power aerial machine.

Quatermain was building four wings of the stag beetle type, each 10½ feet long by 2¼ feet wide presenting 90 square feet of surface to the air. The device weighed 350 pounds with its 212-pound operator. The latter worked both handles and treadles and was able to move the wings, which were 25 feet from tip to tip, so as to produce a double stroke for every single stroke of his body on the motive shaft.

Quatermain, unable to rise, nevertheless thought the force exerted was greater than his weight of 212 pounds and decided refinements were all that were needed.

The gentlemen we have met were those who thought man could fly. Now for two who thought he couldn't. As far back as 1680, in Besnier's time, a Neapolitan named J. Alphonse Borelli said that man could not fly. Borelli in 1680 wrote "De Motu Animalium," a book many considered the most important work on animal flight which appeared before the middle of the 19th century. This Italian scientist gave as his conclusion "that it would be impossible for man to fly artificially by his own energy."

Nearly 200 years later, a German state expert on mechanical devices, Von Helmholtz, made a similar statement. Von Helmholtz knew, as did Lilienthal, that with the increase in size of a flying body, work increased in much greater ratio than the volume of the body and therefore than the muscles which must exert the power. He thought that the size of a bird had an upper limit, reached in nature by the large hawk.

END

Airy Chat

(*Continued from page 74*)

weather bureau experts and fliers of well known reputation.

Realizing that you may be in a position to aid me I have decided to ask you for advice and suggestions.

I have every reason to believe there is a good chance to break this record and also as I expect to marry in September the financial returns are no small item.

If any of our readers are in a position to help out in this attempt on the height record, we certainly will be very glad to have them get into communication with Mr. Sullivan as soon as possible.

* * *

WE HAVE had so many requests for the original POPULAR AVIATION cover drawings of late, that we have finally decided to sell these beautiful drawings to those of our readers who desire them for decorative purposes. They are large drawings, beautifully colored and drawn, approximately twice the size of the cover on this issue. They cost us quite a sum of money, but we will deliver them for the modest sum of $20.00 to those of our readers who are fortunate enough to get their money orders in before they are exhausted. They are ideal pictures for framing and hanging in the home of the aviation fan.

* * *

TURNING over the pile of mail, we find one letter signed "An Unknown Pilot", who seems to have views that coincide with ours. Without any more beating about the bush, the Unknown Pilot believes that efforts should be made more toward the side of safety than simply toward increasing speeds that are already far too high for safety. Here he is:

Well, we are going to face some more races this summer that seem to be a step backward rather than forward. Speed, more speed and still more speed, with the attending fatal accidents, are certain to be more to the detriment than to the advancement of popular aviation. Instead of stepping up the speed to 300 m.p.h. or more, why not have a slow landing speed contest that

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will lead to the popularization and advancement of airplanes for the masses?

What use does the private owner have for a plane flying 150 m.p.h., let alone a ship travelling 300 m.p.h.? Such speeds, under the present conditions call for a high first cost, a high operating cost, a high cost of maintenance and danger to property and life. The airplane will never get anywhere until this speed bug is killed, and so long as speed remains the most prominent feature of air meets, I don't believe that the contests prove much for the cause of civil aviation.

I am a believer in lightplane events at the air-meets for the lightplane is the eventual form of the future ship, according to my views. Ability to come out of spins and other predicaments should prove one valuable feature of the contests, while automatic stability, low landing speeds and complete maneuverability should also be featured. Will this time ever come?

We agree that safety contests are the most valuable of all contests, but at the same time it is doubtful whether such events would prove popular with the general admission paying public who pay largely for the privilege of witnessing thrills. It will be some time before the public mind is open to accept anything in the way of safety demonstrations for their minds run in exactly the opposite direction at present.

* * *

HERE'S some more news for our Photo Phans. George Loudermilk, 2645 North Shore Ave., Chicago, Ill., challenges the record of 1,599 photographs claimed by A. A. Askew in the July Airy Chat. Mr. Loudermilk has been collecting pictures for two years and has now rolled up the imposing collection of 2,188 pictures and drawings, covering historic, wartime and modern planes.

* * *

EVERY day brings a flock of letters into this office asking for blueprints of lightplanes or gliders, or for the addresses of persons who can supply such working drawings. Very unfortunately, we are compelled to reply in each case that such drawings would be useless in most parts of the United States because of certain restrictive laws now in effect.

Even though our correspondents did obtain such drawings, and actually built the ship, they would still be unable to fly the ship legally unless they went through the almost prohibitively expensive gestures of sending stress sheets and like data to the various legislative bodies. When things get settled down a bit, then we will be able to supply such drawings to our readers as we have done in times past.

* * *

MR. CARL OGILVIE, the well known World War tactical authority, has a new kind of a story for our next issue. It deals with the meaning of the various decorations conferred upon our aces, and typical incidents influencing the class of decoration issued to our heroes. This should be of particular interest to our World War fans and our photo collectors.

* * *

NOW, in this issue, as an introduction to this great story of Mr. Ogilvie, is an authentic list of the American Aces, and the number of victories ceded to these men. In this list, Eddie Rickenbacker stands first in the number of victories, and then the number of individual victories gradually tapers down to a minimum of five victories per pilot. It will interest you to know how many men, in the American Air Forces, won five victories —and more.

* * *

WE ARE greatly interested in small engines for lightplanes, and hope to get a rattling good story—or even two stories—on the subject of building your own engine at home. These engines have been under production for some time and they bear their Approved Type Certificate.

* * *

WE have a letter from Abraham Murillo, the Mexican parachute jumper, who wrote such an interesting article on Mexican parachutes in the June issue of POPULAR AVIATION. He acknowledges letters from Ed. Lawrence and John Brown, American Parachutists. Mr. Murillo offers to supply us with information on Mexican aeronautic activities, and we welcome such news, which, judging from his first article, will be full of interest to our readers.

* * *

And so we come to the end of another Airy Chat. Here's hoping that we will have some more good news to tell you in our next issue, I'll sign off.

J. B. R.

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Enclosed is my check for $1.50, for which send me three models of your British Sopwith, like those I purchased a month ago. These models certainly can fly, and they stand the hard bumps. *Paul R. Atherton, Binghamton, N. Y.*

Enclosed find my check for $1.50 for which send me three more models of your Sopwith Pursuit plane. I would appreciate your informing me if you have any other models. *Paul R. Atherton, Binghamton, N. Y.*

The monoplane is a dandy model. The weather has been too bad to fly it out doors, but it flies dandy in the house. It's the only 50c model I ever saw that's any good. The aluminum prop sure is neat. *Ben Bodine, Woodbourne, Pa.*

The model sure flies good indoors and out. It makes a three point landing. Please send me 6 landing wheels. I find the wheels so good that I equip stick r. o. g. model with them. *Ben Bodine, Woodbourne, Pa.*

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when everyone heads for the water, either to swim, canoe or cool off—be sure YOU have this Cleveland AMPHIBION with you. You'll have lots of keen times with it. Semi-profile ½" scale. Span 27"; length 16½"; weight 1.2 oz. Colored yellow and blue. Complete Kit FL-301, post-free, only $2.50.

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Flying Pig

(*Continued from page 78*)

C. O.'s nom-de-ranks) is up to now", Matts shouted over to me. "Search me", I answered, "maybe he feels more peaceful while we're cloud dodging, and besides G. H. Q. just loves to receive reports of the great work our dear commander is doing".

"Oh! hold everything, Matts—here comes the answer to an airman's prayer", I breezed in a bold but miserable attempt to be jocular as the headphones buzzed. All heads stretched over the car and waited. I stood up, jerked my thumb seaward, "Full ahead and due east, gang", I shouted. In reply, they all settled down disgustedly and got busy on the controls for they knew this meant that we were to join the fleet.

A FEW hours later we reported to the flagship, by flag signals lowered on a line beneath the car and received scouting instructions.

We flashed our report to the flotilla leader, passed on and hovered over the flagship to pick up any further orders before scouting ahead again, then proceeded as before. This routine carried on until about six in the evening and we were all about at the drooping stage.

Pst, pst, bang, jerk—the after-engine began to kick, Matts climbed out on the rail and tickled her up a bit, the gas didn't seem to be flowing too good —Bingo, she gave a terrific kick and stopped. Matts beckoned me, I jumped over the side on the starb'd rail. "Hop down below, Yank, and give her a jerk", called Matts, in response to which I grabbed the rail with both hands and threw myself downwards, with the three thousand feet of space below and hoping that my greasy gloves would not "let me down", I gave a couple of long swings.

I shouted up to Matts, and we both took a united heave at the prop—one feeble kick—and she quit on us again. We repeated this dose numerous times, until Matts waved down to me disgustedly, and beckoned me to crawl up top again. A couple more short, sharp acrobatics and I was back in the car—"It's no damn good", Matts squawked, "gas is running low and the service tank's plugged"—"looks like 'home James' to me". And, oh boy, you should have seen my face turn into a great big full moon smile. One good engine and a favorable breeze—what do we care,—life began to seem real again. The base seemed nearer already.

BY nine-thirty we were dipping the nose over the sheds at an air station on the Firth of Forth and the landing party was making for the field on the double.

Once in the shed, we all had to step lively for we had to attend to our necessities and get up again as soon as possible, for the regular patrol would be landing in an hour or so. Up went the hydrogen tube, the working party came at the double with the petrol pump, riggers were swarming over the envelope like flies on an over-ripe herring, and Matts was resetting his magnetos. I checked up my ammunition and loaded a further supply of bombs.

Our young pilot was nervously strutting up and down the shed issuing orders in a half bewildered voice, he was nearly all in and did not relish another night ahead any more than we did.

"Cheerio, Cap'n," I breezed as he passed. He just smiled, "it really is most fearfully annoying, isn't it Yank? I'll run over and see if I can scout out something for you from the ward-room."

With these few remarks he disappeared round the side of the shed. Scarcely had he gone when the C. O. appeared on the scene. "Where's your pilot?" he asked of me. "Just gone over to the ward room for some food, sir," I answered. "Run over at the double and tell him to report to me immediately; the R39 is arriving from the south shortly and you fellows will have to get out of here."

By the time we were in running order again it was close to midnight, and the R39 was hovering overhead awaiting landing instructions. The C. O. came over, "Oh, by the way, have your men had their rations?" he asked the pilot, and receiving an answer in the negative, he sent a mechanic on the double to attend to the matter.

The order "hands off" had just been given and we had started to rise when I looked across the field to behold the mess boy from the ward room running towards us with the "grub stake" our pilot had arranged for—just a moment too late.

WE TRAVELED along the banks of the Forth and were soon out to sea again and on our way to rejoin the fleet. As we got further away from the coast, the fog thickened and soon we were completely enveloped. It was not even possible to see both ends of the gas bag, and the engines looked like two balls of fire in the darkness, whilst a string of sparks from the exhaust seemed to be dancing devilishly along the after end of the gas bag.

We got our bearings from two wireless direction finding stations, and pretty well got our position fixed, but for the fact that according to last advices we should have been in the close vicinity of the fleet. We floundered around at about fifteen hundred feet hoping that with daylight the fog would clear, or that we should have sufficiently clear vision, but it was not until about five o'clock that the first signs of sun were breaking through the clouds.

It was not long before the lower clouds were opening up and relieving our eyesights at intervals with the welcome dark patches — all that we could see of the sea. Presently, a peculiar little structure showed up in one of these patches of sea. It looked to be little more than a bit of a mast stuck in the middle of the ocean. Closer inspection proved it to be the famous Bell Rock lighthouse. This definitely determined our position, so we changed our course to get in line with the fleet, but had scarcely done so, when the now

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rapidly clearing fog showed that we must have been hovering over them the best part of the night, but without a sight of them under the dense atmospheric conditions!

Well, it is said that life is just one durned thing after another, and I can surely second this in connection with sea patrolling by air, for it was not very long before the welcome little morning breeze, which had come to sweep away the fog, gradually developed into a most distressing gale.

Over night, the fleet had been joined by two of the larger non-rigid airships, as well as three more of the "flying pig" type and we were now endeavoring to keep in formation. However, as the wind increased, we gradually became scattered, until the first signs of trouble showed up. One of the larger airships off our port beam had developed engine trouble and was being carried away by the wind. Scarcely had this happened when one of our own type made a nose dive for the sea, and was completely wrecked. Two others practically lost control and took a chance of free ballooning with the wind, finally ending up near an air base on the Yorkshire coast.

WE WERE more fortunate for we were fairly close to our own base. So we quickly turned our course shorewards and managed to keep ahead of the wind sufficiently to gain the coast line in a terrific struggle. We were over the high cliffs, and oh boy!! the fun sure had started when she got a bump from the upward air currents, shot her nose almost perpendicular and then everything screeched, jerked, boomed and moaned. The car looked as if it would tear loose any moment. So we hurriedly tried to lighten her aft, got the elevators hard down and engines whirring with every atom of power possible.

She swooned, rocked, dipped, corkscrewed with us hanging on for life, presently the wind eased unexpectedly, she took a terrific downward dive, and we had the devil's own job keeping her from being smashed to smithereens on the face of the cliffs. We could see our base over the hills, only a few miles away, in our tremendous battle with nature's forces. Shooting up and then diving earthwards, we were naturally losing hydrogen and pressure fast.

We had thrown practically everything overboard in order to gain lifting power and were in a general uproar. However, our efforts did not go unrewarded. I climbed out on the rail, shinnied along to the pilot's side and handled the hydrogen and air valves as we dived, swung and reared in our final attempt at a landing. Hurrah! three cheers! great stuff! The landing party had grabbed our landing tackle and at their first heave she made a final dive, hit the ground with a beautiful wallop and the car turned completely on its side. They managed to steady her again and soon we were safe once again in the great lighter-than-air sheds.

I was looking over the damage to the undercarriage, when I heard a stern voice the other side of the car. "Captain Henson, who the devil ordered you to land?" It was our dear commander, thoroughly annoyed at being disturbed at eighty-thirty in the morning. "You will report to me at eleven o'clock and give a full explanation."

"Yes sir," replied Henson, our pilot, dutifully, but with a look fit to kill. Some say "good old C. O."—some say —well I'll leave this to your own judgment.

* * *

Ja'ever fly a pig? You see I wasn't kidding you. Well, now you know all about it anyway.

END

"Mystery S"

(*Continued from page 99*)

cabane which is concealed beneath the cowling and behind the engine. In order to provide a desirable compromise between cockpit capacity and frontal area the fuselage is made wedge-shaped. Structurally it is conventional in that it is built up of welded steel tubing with an absence of internal wire bracing.

This airplane was widely discussed, following its brilliant performance in the National Air Races of 1929, and undoubtedly was one of the large contributing factors in the trend toward the low wing monoplane which is now apparent. In fact it revived the whole aviation industry. It was the fastest commercial airplane in the country at the time, performing up to its specified qualifications. This ship brought about a new top speed for commercial planes having been streamlined throughout, introducing shoes for the wheels and a special N. A. C. A. cowling which previous to this time were practically unknown to the industry.

THE fastest planes we have in the country today are almost an exact reproduction of the Mystery S. For example, the Gee-Bee supersportster, which won the Thompson trophy race of 1931 at an average speed of 236.23 m.p.h., was powered with a supercharged 535 h.p. Wasp Jr. and landed at a speed of 80 m.p.h. The new Boeing Pursuit, being tested by the army, has a maximum speed of approximately 300 m.p.h., is powered with a 550 h.p. Wasp Sr. supercharged and lands at 110 m.p.h. The new Curtiss Attack plane and many others have been designed very closely to the original Mystery S.

After comparing our more modern type ships with the Mystery plane as to power, and finding that all were equipped with more horsepower, I decided that by getting in touch with one of the designers of the Mystery S, I

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might relieve a few questions which had been in my mind. So I drove over to Tri-State College at Angola, Indiana, where Walter E. Burnham is a professor in the Aeronautical Engineering Department.

Our conversation began with the topics of the day, but soon led up to the discussion of the Mystery S. After comparing the speed of the more modern type planes to the Mystery plane, I asked him the following question: "Do you think the Mystery S could compete with the new Boeing Pursuit if it had a 550 h.p. Wasp Sr. installed?"

Not hesitating the least, he immediately replied: "I would prefer a supercharged 535 h.p. Wasp Jr. instead, and with it I am sure it could attain a speed of approximately 300 m.p.h. and land at not over 85 m.p.h."

CONFIDENTLY, he continued discussing the achievements of the ship, never in the least hinting that his marvelous ability as a designer was responsible for its success.

As to the future of aviation in this country, he was quite confident that its possibilities depended upon the airworthiness requirements of the U. S. Department of Commerce, stating that there were too many loop-holes being filled by irrational assumptions. He quoted: "The regulations are due for a general shaking up.

"I can't say that I have, but Mr. Rawdon and myself are working on a design which we hope will outclass the Mystery S in every respect. It is only through better design that the standards can be raised."

I did my best to obtain something about this new design, but he was very clever in avoiding any question concerning its details. I am sure the whole country will be anxiously waiting to see if these two brilliant engineers will again revive the aviation industry. END

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Hunting

(*Continued from page* 82)

The following February we had a warm Sunday, fishing weather, that suggested big minnows and a deep winter pool in the bend of some stream. Our best bait fishing in central Indiana is in the late fall and early spring. The water is clear at that time and the bass gather in the deep parts of the river. The fish taken then are almost invariably big fish. The greatest difficulty had been in locating the good pools. This day I noticed the clear water—the bottom being plainly visible even in the deep stretches and immediately started on an up-to-date aerial still hunt for good old time "fishin' holes." I found them too. And they were far away from bridges and disturbing highways.

On the bottom I could see rock ledges and gigantic boulders, as big as piano boxes, that made me whistle through my teeth in sheer delight at the discovery. That isn't the end of the story. I caught fish out of those pools—big fish that took five inch chubs and ran out a hundred feet of line in a manner that is ecstasy to the big minnow fisherman.

At five thousand feet the earth below is an open book. The hawk and the eagle, and to them good hunting means life, discovered that simple truth countless centuries ago. Of course there are aerial charter companies now that have supply caches deep in the northern wilderness and for a price. They will take you to localities heretofore unhunted and unfished. But I see a day not far distant when the private plane, low in price and operating cost, and efficient in the ability to land and take-off from small field and lake, will begin the sporting quest.

The farmer with a hay field beside good fishing water may reap a big parking revenue in 1950. Spots of transcendent beauty, a summer's journey away by canoe or packtrain, may be weekend watering places in 1960. And countless wings are very likely to be reflected from the waters of Canada's countless lakes when those days are reality.

END

Battling Bootleggers

(*Continued from page* 93)

tomorrow," said the Chief. "We'll fly up in the morning and be ready for our surprise attack."

MID-AFTERNOON of the following day found us at our camouflaged landing field, several miles inland from the Canadian border, our plans carefully reviewed and our trap ready to be sprung.

I cannot recall a more beautiful moon than that I saw rise over those bleak North Dakota prairies that night. Perfectly full, a gorgeous jewel set against a background of star-studded blue velvet sky.

At 9:30 o'clock, about half an hour before the transport was expected, the two police planes rolled down the field and took off for their scouting duties. On their special short-wave radios, they kept in continual communication with our field station.

Minutes passed slowly and restlessly as we all tensely waited for our signal. Soon it came from the police ship No. 6: "We have sighted both transport and convoy. They should pass directly over field. Approximate altitude 8,000 feet."

For fifteen minutes, the Boeing's motor had been warming up, ready to leave on an instant's notice. Hargrave and I quickly strapped on our parachutes, climbed into our cockpits and buckled our safety-straps.

Down on the field the powerful searchlight was thrusting its long shaft of light into the sky directly above it. Hargrave climbed in a wide spiral, completely circling the field to avoid the searchlight's beam. We were at 8,500 feet when Hargrave levelled off, gunned the motor a couple of times to attract my attention and pointed to the west of us.

THERE she was . . . a big silver transport, and boy, what a monster! Evidently her pilot mistook the searchlight for an airmail route marker, for he made no attempt to avoid it. No sooner had the big ship passed through the beam than a trim little fighting plane passed close on the transport's tail. Hargrave turned and wig-wagged to me. I answered his signal and we were off in pursuit.

Hargrave was eager and I'm afraid he forgot all about what the Chief told us. Anyway he roared over the transport's convoy, banked steeply directly on top of it and motioned down. Surprised, he looked back at me, and I shook my head. After all, we weren't looking for trouble; we were looking for the landing field of the liquor carriers.

But the enemy didn't seem very well pleased with their reception in the States, for they opened up with a random volley from their machine gun. That was all we wanted, for by this time I was just as eager as Hargrave to get into action. No sooner had I grasped the trigger and guide arm of the Browning than Hargrave zoomed up sharply and we were flying on our back in the direction of the enemy plane.

I was tense and excited, but I knew this maneuver and watched closely for my chance. Directly over the enemy plane, Hargrave began to barrel-roll. Every time that we came into position I let them have a round from the Browning. We made a few good hits in the fuselage of their plane, but not much damage was done before they

timed our roll and began drilling our wings.

HARGRAVE levelled off—right side up—and dived to get out of their line of fire. Immediately they side-slipped and opened up on us again. "These boys are no amateurs," I assured myself.

The transport had evidently left its course to avoid the air encounter and it was now nowhere to be seen. Its convoy was enough for us right now, however, so I got back on the job as Hargrave spiralled for altitude to gain a position above the enemy plane.

Unfortunately, they conceived the same idea, and several hundred yards to the east we could see the silhouette of the enemy plane rapidly climbing. Our ship proved to be the faster and soon we were well above and ahead of our enemy—roaring wide open directly for them.

Our position now was less than a hundred and fifty yards in front of the enemy plane, and that gap was fast closing up as we sped towards them at over two hundred miles an hour. Timing their approximate speed forward, Hargrave held her headed straight for their nose until a head-on crash seemed almost inevitable.

But I knew the next move, and as Hargrave sharply nosed the Boeing down to dive under the enemy plane I let go a continuous volley with the Browning. It sheared their propellor tips off clean and we saw their exhaust sputter as they cut their motor for a glide.

Apparently no one was injured and Hargrave put her into an easy glide, descending slowly to watch the enemy plane land. North Dakota prairies are good for one thing at least . . . forced landings.

MY battling blood was boiling by this time. I tore off my goggles and helmet and with my pistol in hand, rushed over to the crippled ship. "Say, who the devil told you you could fight?" I shouted to them as they climbed out of their cockpits.

"There's only one man better," came back the man in the machine-gunner's cockpit, "And that's Lieutenant James Patrick of the 351st."

"Well, I'll be. . . . Scotty!" I shouted as I recognized my old squadron buddy, "What in the devil are you doing here?"

"Don't mind me, I'm just working here," he replied with his same old cocky spirit.

Hargrave began a search of the enemy plane. Suddenly he emerged from the front cockpit with an exclamation of satisfaction. "Boy, would you have a look at these maps? If we can't find that field with this dope I know a good school for the blind."

Further searching of the plane disclosed other papers of importance to the department so that the dog-fight was a triumph and success so far as this particular party of racketeers was concerned. END

Autogiro

(*Continued from page 92*)

caused by the movement of the plane—no matter what the direction.

It must be understood that the Autogiro makes use of this latter principle and, as such, it must not be confused with the helicopter which uses power directly applied to its rotating wings. There is absolutely no direct connection to any engine power, once the blades are started in motion. The sole function of the power plant is to propel the machine in forward flight, while the rotor blades convert part of this power into a supporting or lifting force.

For example, when the blades are started, the pilot waits a short time until they work up to their full rotational speed. These surfaces, a small and an actual counterfeit of an airplane wing, are constantly striking air and creating a supporting force. When the ship is aloft, these blades are continually meeting a stream of air forcing them to revolve in much the same manner as a windmill.

To demonstrate this very simple principle, cut out a paper propeller, use a pin as a hub and blow upon the surfaces; they will revolve just as long as the force of your breath strikes them.

The axis of the rotor is approximately perpendicular to the longitudinal axis of the machine. When the plane is descending vertically, the airspeed encountered by all blades is equal. In forward flight, however, this equality is eliminated because the forward speed adds to the velocity of the advancing blade and subtracts from the speed of the one receding.

This difference of air-speed and the resultant difference of supporting force created by the blades, causes an inequality of lift. Unless means were taken to reconcile this variation, which is felt by the advancing and receding blades, the machine would tip in relation to its line of flight and lose its stability.

IT SO happens, however, that each blade is hinged to its rotating shaft and is free to yield either up or down, and because of this, the advancing blade will automatically rise with the greater air speed pressure and will work at less effective incidence. The receding blade, meanwhile, will automatically descend because of decreased speed and will work at a more effective incidence because of its position relative to the air stream. In this manner, a balance is constantly preserved and there is no sudden force tending to overturn the Autogiro at high forward speeds.

If the picture of these rapidly revolving blades is clearly fixed in your mind, you might ask: "Under the strain of lift, because they are hinged to permit free action, wouldn't the rotor blades tend to do two things: (1) create a great strain on the hub by suddenly rising to its top and, (2), bend like a branch of a tree if pushed upward upon the unsecured end?" This is a well-put question. It is true that the blades have this tendency to rise under lift, but there is also a compensation made.

Primarily, the blades are subjected to two major and opposed loads. One—rising tendency—has just been mentioned; the other—centrifugal force—helps to counteract this dangerous rise by acting at right angles to the lift force. The throw of the blades, as they revolve, creates a force which is pushing directly away from the hub with a great deal of power and which serves to make it difficult for the blades to rise as freely as they might. To prove this action, take a piece of wire and wrap one end around a smooth steel rod.

THE load placed upon the blades is therefore carried by the tension system, made possible by hinging the blades in order that centrifugal force might work against the rising tendency of them. At the same time, harsh bending stresses are eliminated and flexibility is introduced which enables the rotor to easily adjust itself to bumpy air, thereby taking from the ship many of the shocks which would ordinarily pass through it. A second hinge is also attached to the blades to give additional freedom in the plane of rotation.

We must remember that the rotor forms an almost flat cone because of each blade attempting to adopt a position of equilibrium between the centrifugal force and the blade lift. In vertical descent, the coning angle is the same in all directions from the rotor hub. This is because each blade receives the same amount of air pressure. With forward speed, as mentioned be-

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fore, this coming angle is slightly distorted because the advancing blade rises above this angle while the receding blade drops below it. If we picture the thrust line as the axis of this cone, we can see that it moves forward with an increased angular tilt and, likewise, moves forward with respect to the center of gravity of the Autogiro as a whole.

This flexibility of the thrust line's movement makes the rotor stable in all directions and does not interfere with the gravity position which the plane itself must maintain.

Added to the above is the fact that the hinging device makes it possible for the rotating blades to follow the fuselage of the ship during maneuvers with less resistance than the fixed wings of an ordinary airplane. If the blades were not hinged to permit easy oscillation, it would be possible to cause considerable structural damage by violently rolling the ship and bringing the blades sharply up against their check cables.

It so happens, however, that the relative incidence of the blades is changed with the slightest tilting of their hub and the air-stream immediately carries them into a corresponding fuselage position, thus relieving all strain. Shorter radius turns are also made possible because of the extremely low forward speed.

IF THE blades were cantilevers from the hub (solidly attached to one end) great bending movements would also occur at the hub itself. Articulation (free movement through hinging) prevents this and permits the use of a much lighter blade than would otherwise be necessary. A pin end at the root of the blade eliminates any bending at that point.

Actual stresses on the blades, not taking into consideration local stresses due to fittings and attachments to hub, include tension, a small amount of bending and a slight torsion. All of these are reduced to a remarkable degree and do not detract from the stable aerodynamic features of the rotor.

We must now consider the manner in which a correct working arrangement is arrived at between the fixed wing and the rotor. It was necessary to design the former so as to secure the proper location, area, and incidence and to prevent any undue loss or increase of rotation in the rotor. The original Autogiros were laterally unstable at high speeds because of the small fin area formed by the fuselage and the vertical surfaces. At the present time, the use of greater dihedral in the fixed wing surfaces and the turned-up wing tips corrects this fault.

As you noticed in your flight, the general system of controlling the Autigiro is like that of any other airplane. It should be mentioned that the downwash from the rotor creates enough air-stream around the ailerons and rudder to make them effective for all conditions of flight.

There has been a great deal of discussion as to the load placed upon the fuselage and control surfaces due to the Autogiro being supported by the rotor instead of the fixed wings doing the work. From the above remarks pertaining to its operating principles, it is not hard to see that the rotor itself, under the reaction of an accelerated load, becomes a great supporting agent.

As to the question of how much the loading of the Autogiro will be increased in the future, it is only possible to say that there will undoubtedly be an improvement in this respect.

END

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Old "DH"

(*Continued from page* 103)

distance of 1,118 miles, in 9 hours and 20 minutes.

Captain Lowell H. Smith and Lieutenant J. P. Richter, pioneers in refueling duration flights, on June 27-28, 1923, demonstrated the practicability of sustained flight through the refueling process.

Failure of the reserve gasoline tank forced these flyers to descend after being in the air continuously for 23 hours and 48 minutes. Two months later, on August 27-28, these two pilots flew non-stop from Canadian to the Mexican border, a distance of 1,280 miles, in 12 hours, 13 minutes and 40 seconds, their plane being refueled in the air over certain pre-arranged points.

And now it is literally "wiped off the books." The Liberty engine, with which it was equipped, still survives here and there in the Army, principally in a few O-11 Curtiss Falcons and Douglas 02H's used by the National Guard. How long before this "war-baby" goes the way of the planes that are no more?

END

Like Their Jobs

(*Continued from page* 98)

Stunts, stunts, stunts! One eighteen year old lad hauled out a copy of "Aerial Acrobatics", a pamphlet published by the Army Air Corps, and told me that he used it at home to justify his attempted Immelmans and rolls against parental displeasure. Of the night flyers, one lived in Los Angeles, one in Washington, D. C., and each lad (fifty-hour men) said they were fascinated with the aerial nocturnal view of their respective towns. Can you, who have seen these cities by night, blame them? Which leads me off the subject to ask, which town in this country looks best from the air by night?

Oh, yes, of the other amateurs, two wanted to soar and soar all day long. One was starting for Cape Cod, the other had organized a soaring club in his town. Four lads, who were pretty good pilots, wanted to do service flying and one was already applying for a Reserve Commission. The one who preferred the Navy said he'd give ten years of his life to fly off a carrier. He'd seen "Hell Divers" for three days' running—three performances a day. Can you beat such enthusiasm?

The Armyites had seen the Air Corps maneuvers the last few years and knew a number of Army pilots. These three liked the idea of aerial gunnery, mass formation work, life at an Army field. Yes, and even the discipline. Others hoped some day to fly for Uncle Sam, somehow, somewhere, although their present worry was improving their pilot technique.

And now for flying employees. Two stewardesses, whom I questioned, said that they would like to serve on night Pullman planes, whenever they came into regular use. Two mechanics said that the biggest kick they ever got was sitting alongside the pilot, checking the beacons, the border lights of emergency fields, the towns and cities and just seeming to push on through space. Handlers of wrenches with the souls of poets!

TWO ground radio men said they'd like to connect with some big company that hired radio operators on their planes. An engineer stated he'd like to connect with the Navy in a civilian capacity and another, a bear for trouble and hard work, said he'd like to be the head engineer-mechanic with an isolated exploration party.

Another, who flew at irregular intervals, said he liked night flying—"It's like reading a spooky detective thriller." And the one who wanted to get on a non-flying basis confessed, "I'm getting fed up. With plenty of good pilots that I *might* get to fly behind or alongside of, why is it that my partner gets the good ones and I get the clucks? I ask you, is that a way to treat a guy?

"Some of the bozos I fly with are not as good pilots as I am. If they can get their license I oughta have ten licenses given to me. Only the necessary solo time keeps me from taking the pilot's exam—s'welp me . I wish I could get back on the burlesque stage."

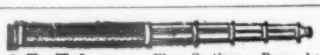
Those whose money makes the wheels go round—the habitual passengers—seem to like the scheduled transport runs, although one liked a small open cockpit job. So I put him down as preferring a mail run as passenger. Two had once flown as passengers in Army planes during maneuvers and one had been a flying gob and seemed to prefer that kind of flying.

Said a passenger, recently alighted from a Ford trimotor at Cleveland, "I'd like to follow a plane from its inception on the draughting board to its test in the air. Best of all, to ride with it on the test flight, to see if it justified the faith of its engineers." He then departed by auto for the Great Lakes plant outside the city. The last lad I asked had flown over most of the world's airways and new country. To explore by air was what he'd enjoy best.

IN SUMMING it up, it seems that most pilots are interested in their job, except that of pay-hopping, which no one really got enthusiastic over. It was surprising how many liked night flying and how the flashing and blinking of lights, the lighted contours of towns and cities, the dull slate-colored bodies of water and other aspects of night flight appealed to them. (Boy, it's getting me too. Think I'll run down to Greensboro tomorrow night.)

What flying do you like to do? Place yourself in the class I mentioned and see if you fall in with the majority or the know-what-I-want minority. But there's one thing about flying—out of 100 flyers interviewed only two hoped to quit the game, and the only one of these two who was serious, was going to stay in aviation anyway. Put that up against any other calling, profession, pursuit or hobby!

END



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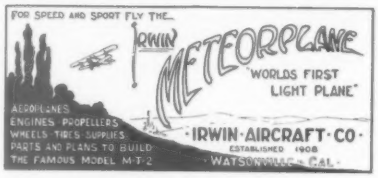

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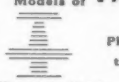
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WOBURN MODEL AIRPLANE SHOP,
17 Belmont St. (Dept. P-8), Woburn, Mass.

Diesel Engines

(*Continued from page* 102)

solute ceiling in these tests was 20,000 feet. The forward speed was then 82 miles per hour and the engine turned 1,750 r.p.m.

The latest refinement in regard to this engine has been the development of a method of throttling by the introduction of a barrel valve in the cylinder air intake. The valve was given ample clearance to permit entrance of enough air into each cylinder to keep it firing, but at the same time the valve provides sufficient braking action on the engine to slow it down when idling in a glide or a dive. Thus was a serious difficulty solved.

A second American aircraft diesel is the Guiberson aero diesel. This powerplant operates on the same fuel and principle, but differs in minor details which are somewhat unusual. There is a different method for obtaining idling speed.

This engine can be idled to low speed with the timing of the injection advanced approximately 12 degrees before top dead center combined with a device controlling intake turbulence in the individual cylinders. Both these modifications are controlled automatically by the throttle. The propeller can be allowed to turn freely in a glide, with dead engine, by decompression.

The Guiberson diesel has completed a 50 hour test for the Department of Commerce and has made several important flights in this country. Its chief characteristic, from an engineering standpoint, is the concentric pocket forming a symmetrical combustion chamber in the outer end of the piston head and also the decompression ring in the fuel pump. Its weight per h.p. is 2.74 lbs., the engine producing 185 h.p. at 1,925 r.p.m. with a weight of 506 lbs. The engine operates smoothly at a pressure well under 1,000 lbs.

The Romeiser diesel is a further departure from conventional fuel oil engines, being a practical application of the sleeve cylinder, with one cylinder working inside another to obtain valve action. Furthermore, the oil and air are admitted prior to compression at the bottom of the stroke, being compressed and fired in the usual manner but without the solid fuel injection after compression.

It is a 160 h.p. engine as produced in the laboratory model, standing 26 inches high with four 3 inch cylinders. The base of the engine is four feet wide, and its dead weight 264 lbs., or just under 1¾ lbs. h.p. The originators of this motor claim to have developed with it as much as 53 per cent efficiency, but like so many others, it has yet to demonstrate its worth in the grueling grind of actual flight over long periods.

AN engine, better known in European and other engineering circles than to the public generally, is the Junkers diesel made in Germany. It is a workable engine combining many unusual and worthy features. The operation involves a fuel pump, atomizer and injector, with the injection taking place at the usual high-compression point.

Most unique is the employment of double opposed cylinders, firing occurring between the opposing pistons and forcing them to retreat away from each other. Each set drives two shafts connected by sprocket and chain. The top shaft is the propeller shaft.

A Junkers "Jumo 4", which has made many flights around cities in Germany, weighs 1,760 lbs., and delivers 720 h.p. at 1,700 r.p.m., or approximately 2.4 lbs./h.p.

Another school of design, represented by the Sunbeam Motor Car Co., Ltd., of England, believes that a suitable diesel can be built with water-cooling and other refinements. The Sunbeam diesel for aircraft is a six in-line motor, water-cooled engine, with a weight of 4.35 lbs./h.p. It delivers 104 brake h.p. at 1,500 r.p.m.

The final word in fuel oil power plants, according to advanced ideas of many engineers, will be the turbine diesel. Considerable experimenting has been made along lines calculated to produce a reliable diesel turbine, resulting in many failures and at least one promising design.

END

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Howl Dept.

(*Continued from page* 88)

Will you please publish something about the red tape necessary to get an "X" and an "N. C." on a home-made ship? Someone told me I could send to the D. of C. at Washington and get a stress analysis to build a ship by. Do you know if that is so?

Yours truly,
James Green.

No, the petition blank on page 346 does not apply to amateur aviation. The petition blank for this cause has not yet been printed, and will not be, for some time.

The calculation of stresses is so complex, and so many engineering principles are involved, that I doubt whether anyone outside of a trained engineer could do much with the stress sheets even though they got them from Washington. Better have an engineer check up on this work than to attempt it yourself.

* * *

A VERY instructive and constructive letter has been received from Leland I. Silsby, 518 E. Liberty St., Ashland, O., who has apparently spent much time investigating the numerous problems now confronting the amateur flyer and home-builder. All this is very encouraging for our cause.

END

Q. & A.

(*Continued from page* 104)

from tests made on other samples. This particular piece of metal might be weaker than other samples of the same material, it might be slightly undersized or improperly machined. Thus, to be on the safe side, this part is made several times stronger than would be indicated by tests to cover unknown errors.

The safety factor also varies according to the method by which it is loaded, whether it is subjected to steady loads, rapidly varying loads or shocks. The safety factor is necessarily greater with varying loads and shocks than with steady loads, for it is difficult to exactly foretell the magnitude of a shock, or a sudden blow.

Thus, a steady load may call for a safety factor of four, a varying load might demand a factor of eight, while suddenly applied loads or shocks might demand a safety factor of 20.0 or 30.0. That is, the part to resist the load would be anywhere from four to 40 times stronger than absolutely necessary for exactly carrying the load.

* * *

QUESTION:—Sam Hart, Waukegan, Ill. *What should be the size of the tail surfaces of a lightplane; that is, the area of the rudder, stabilizer, elevators and fin? The span is 28 feet, and the engine is a 50 h.p. radial.*

ANSWER:—THE calculation of tail surfaces is quite a complicated matter requiring much more data than given in your letter. The tail group is directive in nature, turning the nose of the ship up or down or right to left. The surfaces act through the body of the ship like a force applied to the end of a lever, hence the distance of the group from the center of pressure on the main lifting surface is required. In addition to acting in a directive sense, the surfaces also serve as a means of damping down oscillations and vibrations, and this requires another calculation. In short, the calculations of the tail surface are engineering problems that should only be undertaken by a trained engineer.

* * *

QUESTION:—Robert Schmeling, Phoenix, Ariz. *What are "N" struts?*

ANSWER:—THE "N" struts take the place of the old incidence wires used on biplanes to hold the wings at the proper angle. The "N" struts are made of tubing, and are inclined between the front and rear vertical struts in such a way that the struts form the letter "N".

This will be seen from the photo of the Boeing Combat plane where the "N" is clearly shown near the ends of the wing.

END

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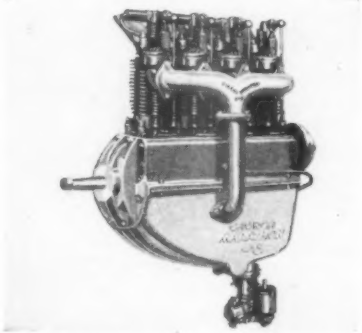
"Power Increased"

WATCH THE MANY TYPES OF SPECIAL AIRCRAFT ENTERED IN THE 1932 EVENTS EQUIPPED WITH J-3s—WATCH FOR THE RESULTS OF THE CHURCH ENCLOSED RACER



The Marathon J-3 engine was designed to be in the $500-$600 field of finer light aircraft engines, but the surprising large demand for this engine has made it possible to sell it for only **$350**

Your present Henderson or B-4 motor will be accepted as part of your payment.

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Many aircraft manufacturers are now using the "Marathon J-3" for dependable power because of the power output per pound of weight.

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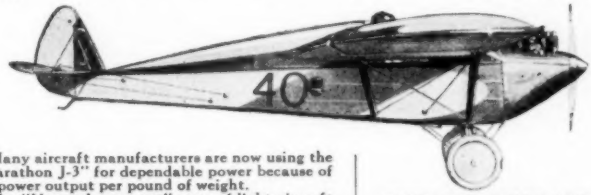

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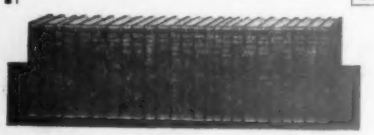

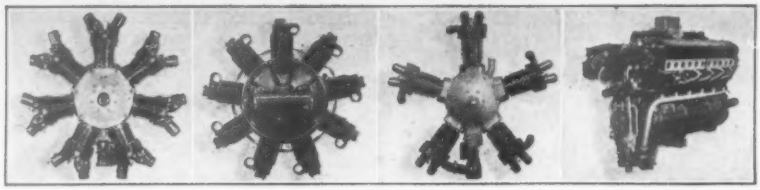

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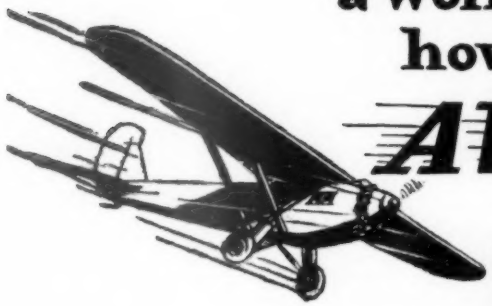

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